The Signature Series

April 24, 2000

Volume 17, Number 17

NetworkWorld

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Special coverage begins, page 55

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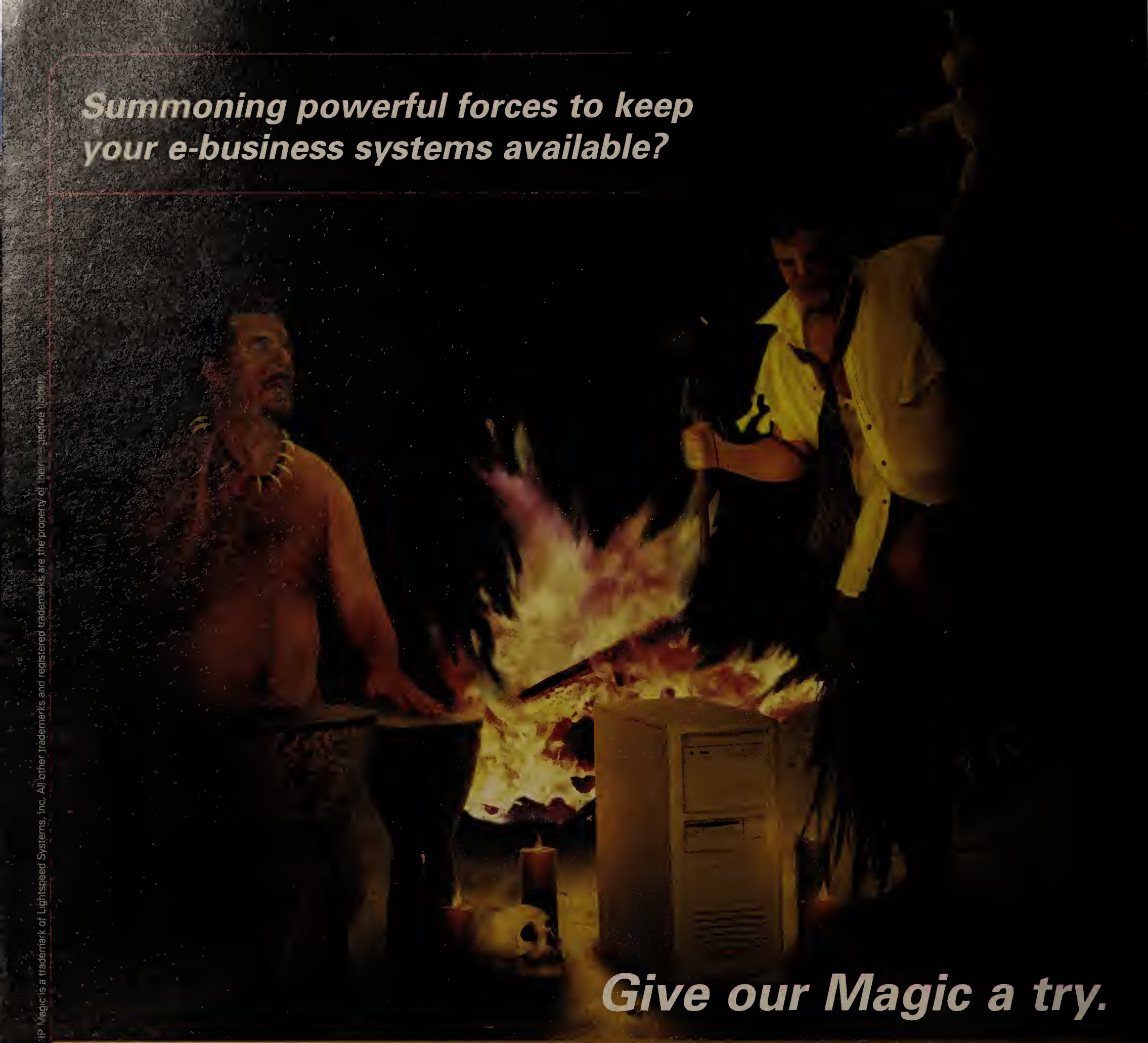

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Page 55

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CIRCULATION: Phone: (508) 490-6444; Fax: (508) 490-6400; E-mail: nwcirc@nww.com; **STAFF:** See the masthead on page 18 for more contact information. **REPRINTS:** (717) 399-1900

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RESEARCH

Spider Bytes: The Web's best tools and tips

Are you managing a token-ring network? We've got resources to help you **(DocFinder: 7832)**:

- Get your team up to speed on token ring with a visual primer from Datacottage.com.
- Learn about the latest standards efforts of the Token Ring Consortium.
- How does Linux work with token ring? Download a demo from the Linux Token Ring Project.

Newsletters

From the **"Web Application Development"** newsletter, **DocFinder: 7833**

"This is a really weird idea: Managing your Internet servers with Palm handheld computers. But I guess I must be missing something here because IBM certainly thinks the idea has legs."

Sign up for this and other free e-mail newsletters online at **DocFinder: 3850.**

FORUMS

"The reality is that taxing e-commerce, even if we all agreed to do it, is simply too complex. There are more than 6,000 tax jurisdictions in the nation, and each decides on its own what is taxable."

— *Massachusetts Gov. Paul Cellucci in the "Taxing the 'Net" forum,* ***DocFinder: 7834***

Other forum topics:

ERP prerequisites

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COONEY'S CORNER

The best of the NetFlash daily newsletter

Employee study cites rampant Internet abuse

In the no-brainer study of the week, I give you this one from Elron Software of Burlington, Mass. More employees are checking their stock prices, shopping for travel bargains and exchanging personal e-mail via the Internet while at work — even though their companies prohibit these activities. The study found a significant increase in the number of companies with Web and e-mail usage policies. But the study also found that despite these policies, employees' personal use of corporate network resources is rising. **DocFinder: 7841**

SBC calls on Cisco to help build its $6 billion network

Cisco continues its unrelenting march toward world dominance. SBC Communications last week said it will use Cisco gear in its ATM backbone, and it has named Cisco as its preferred supplier of network hardware for customized services to enterprises. The agreement announced Wednesday gives Cisco an edge in competing for contracts to supply gear for SBC's $6 billion Project Pronto, a network overhaul that will bring digital subscriber line services to 80% of SBC's customers. **DocFinder: 7842**

Comdex: Clinton urges action on 'digital divide'

Bill does a trade show. In Chicago last week, President Bill Clinton challenged U.S. high-tech companies to get involved in programs aimed at closing the gap between the technology have and have-nots, the so-called "digital divide." In the first presidential address ever to a high-tech trade show audience, Clinton said it was crucial that IT companies spread new technologies to underprivileged people in order to continue the current economic expansion. **DocFinder: 7843**

— Michael Cooney, associate news editor

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COLUMNISTS

In the Works

The spammers among us

Internet Mail Consortium Director Paul Hoffman says the really dangerous spammers are legitimate companies with overzealous marketing departments. **DocFinder: 7836**

Keeping Current

Mum's the word

How can a company own an overwhelming majority of a market and manage to keep it a secret? Fred McClimans says to ask 3Com and its wireless group. **DocFinder: 7837**

Help Desk

Foggy Outlook

Problem: A reader is having difficulties with users dialing in to the network. They can't access Outlook to check their messages or calendars. **Solution:** Find out what Help Desk Editor Ron Nutter suggests. **DocFinder: 7838**

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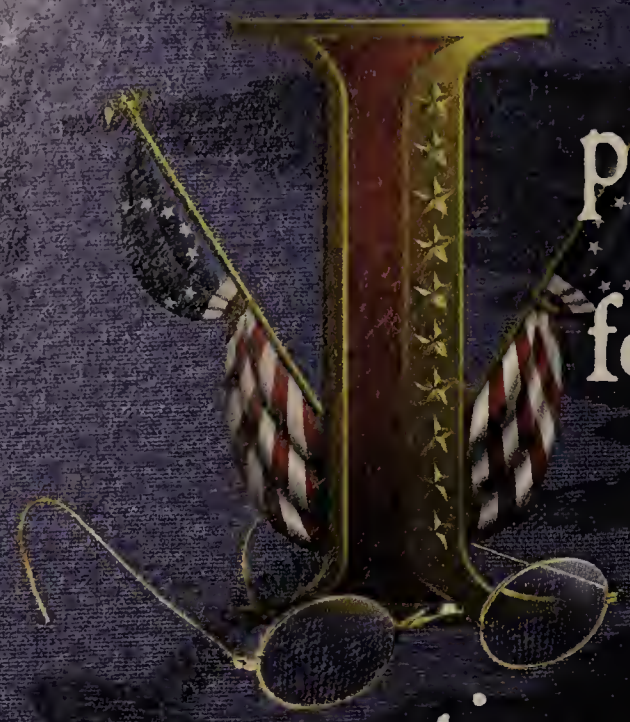

I predict future happiness for Americans, especially if this teleworker integration thing really takes off.

—THOMAS JEFFERSON [FOR THE MOST PART]

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ARCHITECTS OF AN INTERNET WORLD

News

Novell touts online server fix

Knowledge system can determine why NetWare servers conk out.

BY DENI CONNOR

PROVO, UTAH — Managers of NetWare networks can now find out why their servers fail and bring them back online faster with software Novell is testing on the company's Web site.

Dubbed the NetWare ABEND Analysis System, the software determines why a NetWare 4 or 5 server fails or abends (abnormal end).

To use the ABEND Analysis System, the user uploads a log file the server keeps called the ABEND.LOG. This file lists information that is helpful in solving server failures, such as the process running at the time of the failure, the most recent entries in the memory stack, the instruction that was last executed and a list of modules running on the server.

The ABEND.LOG is analyzed by a Novell database of known causes of abends, and the user is given an answer within seconds. Each new abend incident is added to the database, also known as a knowledge base, to help future customers with their abend situations and increase the system's effectiveness.

"[The ABEND Analysis System] is the greatest thing since sliced bread," says Chip DiComo, network manager for Hellmann Worldwide Logistics, a shipping company in Miami. "For most network administrators, unless you can read the code that is generated when the ABEND happened, you don't get very far. It would have been nice to do an analysis rather than getting on the phone with someone."

Most servers fail because third-party software running on them is not compatible or systems are not updated with the latest patches, says Dirk Smith, president of server-recovery company Alexander LAN in Nashua, N.H. Alexander offers a Server Protection Kit, or SPK, that solves server failures and automatically submits data to Novell's ABEND Analysis System for future problem solving.

Smith says fixing abends is a haphazard process, riddled with complex problems a network manager is not typically trained to handle. Novell says that most server abends can be resolved by reading a memory listing kept on server activity, called a Coredump.

"Abends are often difficult to diagnose, whether the cause is hardware or software," says Michael Carroll, IT consultant to the Australian Agency for International Development in Canberra. "This tool would build a knowledge base of abends around the world, and eventually you could see trends appear in what is causing certain errors."

Even if network managers See **Novell**, page 146

Observers skeptical of Win 2000 Kerberos plan

Critics see issues with licensing, interoperability.

BY JOHN FONTANA

In an attempt to answer interoperability questions about its implementation of Kerberos security in Windows 2000, Microsoft is finally preparing to reveal a key proprietary data format it has been guarding for nearly two years.

But while IT executives and standards watchers have hoped that Microsoft would publish the data format, they are now concerned about a possible Microsoft plan to license the technology instead of making it freely available. They say that action would continue to needlessly tie Kerberos users to Win 2000.

Kerberos is an Internet Engineering Task Force standard authentication and authorization mechanism. Ideally, a standards-based implementation of Kerberos allows for network or Internetwide authenti-

See **Kerberos**, page 148

MORE MICROSOFT NEWS

Windows in hand

Microsoft's new Pocket PC operating system and several new handheld devices are set to take on Palm. Page 18.

THE WIN ME SYSTEM

Will the next revision of Windows be network friendly? Page 148.

Symbol's PTT2700

The last mile access race is heating up

BY TIM GREENE AND DENISE PAPPALARDO

The Internet of the future is based on everybody having blazingly fast access. So how do we get that broadband speed over the crucial last mile?

Three technologies — cable modems, digital subscriber line (DSL) and fixed wireless — are contending to supply much of this bandwidth. But none of them has yet emerged as the clear winner.

Handicappers say the two hottest prospects for last-mile technology are cable modems and DSL. Both use networks already in place and that, for all practical purposes, reach nearly all remote business sites and telecommuters between them.

BROADBAND ACCESS BLITZ

First in a three-part series.

Lagging behind is fixed wireless, still waiting for service providers to build the infrastructure they need to deliver services widely.

While all three access methods can supply multimegabit speeds, none is perfect:

- Cable modems provide up to 10M bit/sec over a shared network. So if you are on a heavily used loop, your bandwidth plummets. Cable modem access costs about $40 per month.
- DSL runs over regular phone lines but has distance limitations and is sensitive to copper wire quality. DSL access costs $40 to hundreds of dollars per month, depending on bandwidth and service-level guarantees.
- Fixed wireless offers speeds up to 155M bit/sec, but weather can be an obstacle and there must be an unobstructed line of sight between broadcast antennas and customer sites. Some 384K bit/sec services cost about $150, and some providers claim to undercut local wired access by 30%.

Customers can weigh the options and pick their favorite, but chances are they won't have a real choice. Places where DSL, cable and wireless providers compete are still the exception.

"Service providers now are just trying to get customers, not take customers away from each other," says Jamie Mendelson, an analyst with The Strategis Group in Washington, D.C.

If you consider the number of potential broadband customers, service providers have barely scratched the surface. Total sales of cable modem and DSL services at the end of 1999 were less than two million lines — barely a statistical blip in a country with 146 million business and residential phones, according to Insight Research.

Based on that small sampling, cable modems hold a clear lead over DSL and wireless, but DSL looks ready to come on strong. Cable providers have 1.1 million modem customers, according to estimates by The Yankee

See **Last mile**, page 150

NEWS BRIEFS, APRIL 24, 2000

Clinton issues call at Comdex

Marking the first such address by a U.S. president at a trade show, President Clinton last week challenged high-tech companies to get involved in programs aimed at closing the gap between the technology haves and have-nots. Clinton said it was crucial that IT companies spread new technologies to less-privileged people in order to continue the current U.S. economic expansion. "I am asking you to do this because you can. I'm asking you to do this because it's right," Clinton said in his keynote address at Comdex in Chicago. Specifically, Clinton asked IT companies to support his call to action issued at a White House briefing April 4, challenging corporations to take concrete steps to connect every U.S. classroom to the Internet and make home access universal.

Clinton says share the 'Net wealth.

Nextlink's 'Generation' fills gap

Nextlink is filling a gap in its offerings by adding a battery of broadband Internet services to its voice portfolio. The services, dubbed Generation Next, include digital subscriber line (DSL) Internet access and Web hosting, as well as additions to Nextlink's local and long-distance services. Generation Next paves the way for Nextlink's planned purchase of Concentric Network, which will provide the DSL and Web-hosting services. The $2.9 billion deal was announced in January.

Heavy metal lands on Napster

Heavy metal group Metallica and its music company last week filed suit against Napster, the University of Southern California, Yale University and Indiana University over copyrighted music being stored on computer systems. The suit states that the defendants are committing continuing copyright infringements, unlawful use of digital audio interface devices and violations of the Racketeer Influenced and Corrupt Organizations (RICO) Act, according to a statement issued by the group. Napster, a software application used to download MP3 files, has been the source of much controversy lately. A large deal of that is based around a lawsuit by the Recording Industry Association of America, alleging that Napster runs a haven for music piracy. In reaction to the suit, Yale and Indiana denied liability but nonetheless began blocking student access to Napster. Yale in turn was dropped from the lawsuit.

Red Hat takes on Bluecurve hue

Red Hat Software said last week it plans to buy performance management software maker Bluecurve of Oakland, Calif. Bluecurve's software measures transactions and user activity that place demands on a company's Internet-related hardware and software. Red Hat plans to use Bluecurve's software to build a services program for its customers. Bluecurve's software evaluates server, network and application performance. Red Hat will issue up to 1.2 million shares of Red Hat common stock in exchange for all outstanding shares of Bluecurve to complete the deal.

Mounties nab 'MafiaBoy'

The Canadian Mounties always get their man, or so the saying goes. But in this case it's a 15-year-old hacker nicknamed "MafiaBoy." The teen was nabbed as the culprit in the February distributed denial-of-service attacks on Web sites owned by CNN.com, Yahoo, eBay, Amazon.com and others. Working with U.S. authorities at the FBI, Royal Canadian Mounted Police traced the network attacks back through the Toronto service provider, Internet Direct Business Solutions. MafiaBoy, whose name is not being released because of his age, aided the investigation by bragging on Internet chat forums that he launched the attacks. As part of MafiaBoy's bail conditions, a Canadian judge has ordered the teenager confined to his home unless under adult supervision. MafiaBoy is also forbidden to use a computer, a library or any place providing online services. If convicted, he faces up to 10 years in prison for data mischief.

Oracle backs TurboLinux

Oracle has taken an undisclosed equity stake in TurboLinux, a San Francisco Linux software distributor specializing in high-performance servers. As part of the deal, TurboLinux will tweak its server software to support the Oracle8i database. The goal is to give enterprise customers a fully supported, Linux-based data server as a foundation for large-scale e-commerce applications. The TurboLinux Server software will be tuned for easier installation and management of Oracle8i. The operating system supports up to 4G bytes of RAM on 32-bit Intel computers, a feature called "Raw I/O" for faster access to disk storage and the Motif 2.1 graphical interface.

Network World debate to test 'last mile' views

BY DAVID ROHDE

LAS VEGAS — If we're finally on the cusp of a tremendous leap forward in terms of inexpensive broadband access to WANs and the Internet, how can you take advantage of it?

And which carrier is best positioned to provide it?

That's the subject of *Network World's* upcoming Broadband Access Showdown, a keynote-level session at NetWorld+Interop 2000 in Las Vegas next month.

Top executives from five of the leading carriers in broadband access technologies will take the floor in a debate moderated by *Network World* Editorial Director John Gallant.

Executives from national giants AT&T and MCI WorldCom, Bell powerhouse SBC Communications, broadband specialist Qwest Communications and wireless local loop pioneer Nextlink will debate some hot issues — digital subscriber line (DSL), cable modems and other high-speed local-access technologies.

There will be no PowerPoint presentations, no repetitive theoretical discussions and no canned 20-minute sales pitches. Instead, the five panelists will be questioned first by *Network World* News Editor Bob Brown and Senior Editor David Rohde in a round-robin format, with no rehearsal and no advance knowledge of questions. Then the panelists will have a chance to ask each other questions.

At the Showdown, two broad areas of key importance to network professionals will be emphasized. First, for corporate sites, can users really start thinking about DSL, cable modems and fixed-wireless local bypass systems, or should they just leverage these options with their carriers to get less expensive T-1 lines?

And for broad rollouts of high-speed small office/home office and extranet architectures, the discussion will look at which — if any — of the technologies offer the kind of broad availability, reliable installation and solid performance that network managers need.

There's no sense installing a new WAN technology only to have your carriers point fingers at one another after the lines are in. Instead, come to the Network World Broadband Access Showdown, and watch the carriers question each other at no risk to you. ◪

Vegas showdown

NetworkWorld SHOWDOWN Broadband Access

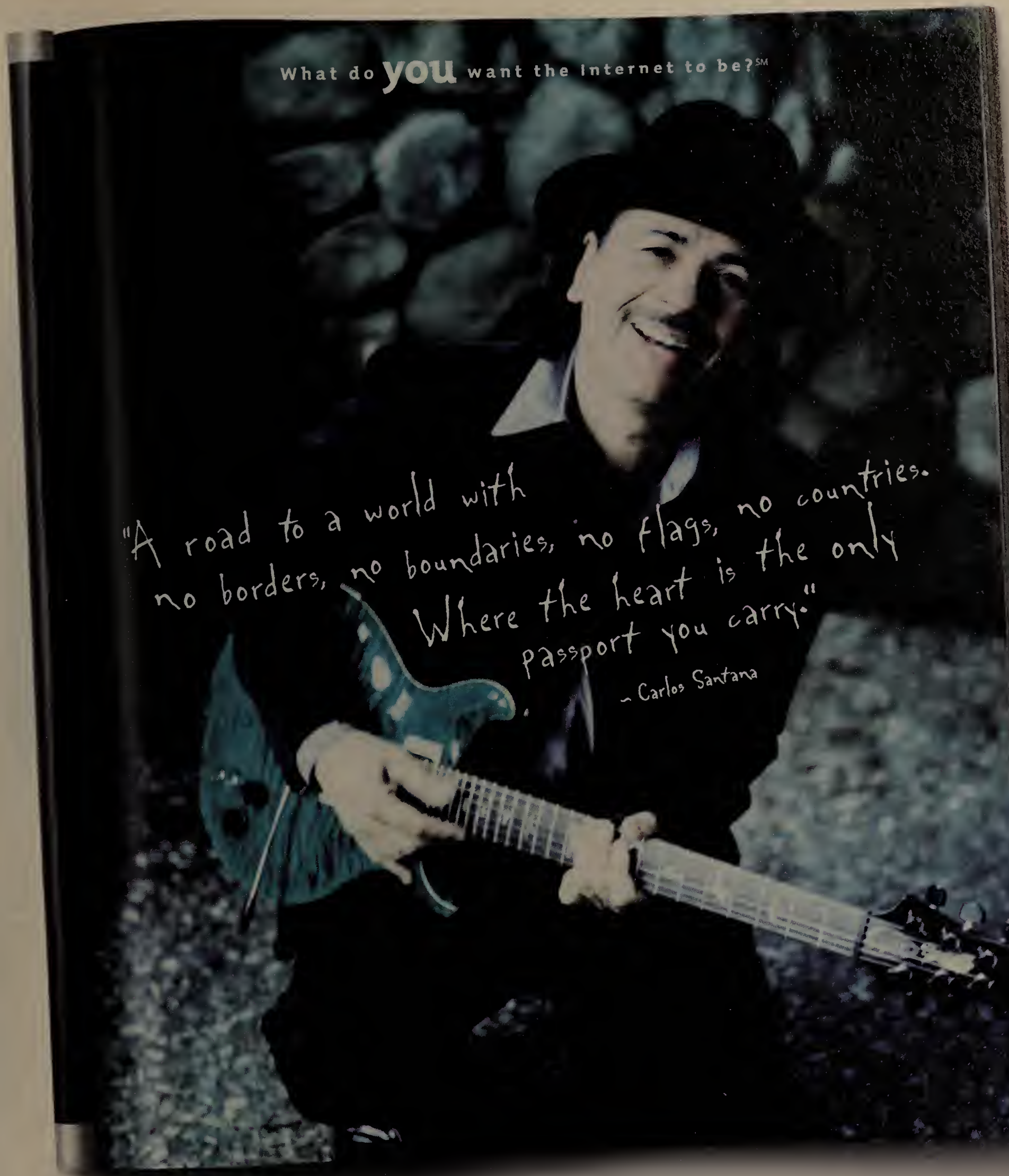
What: A presidential-style debate on the future of last-mile network access.

Where: Las Vegas Convention Center, Las Vegas

When: Tuesday, May 9, 12:30 p.m. to 1:30 p.m.

Who: Moderator: John Gallant, editorial director, *Network World.*

Expert panel: *Network World* News Editor Bob Brown and Senior Editor David Rohde. Vendor panelists: J. Michael Jenner, vice president with AT&T Data & Internet Services; Fred Briggs, chief technology officer, MCI WorldCom; Doug Carter, senior vice president and CTO, Nextlink; Augie Cruciotti, senior vice president of Qwest Link, Qwest's DLEC/CLEC operations; Jason Few, vice president, broadband communications, SBC Communications.



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How the world shares ideas.

Online supply chains creating buzz, concerns

UCCnet food industry exchange may be most ambitious example to date of e-commerce trend.

BY ELLEN MESSMER

CHICAGO — A new type of business-to-business trading exchange is arising that not only allows a buyer to place a purchase order with a supplier, but also keeps an electronic trail of the items ordered through the entire shipping, logistics and billing processes.

Online supply chains were a hot topic at last week's Retail Systems 2000 conference in Chicago, where thousands of retailers from around the world convened to share stories and wander among the vendor booths.

Among the dozen or so online supply chains that have recently sprung up are NonStop-RX.com for the pharmaceutical industry and Retail.com for apparel manufacturers and buyers. But the most ambitious may be UCCnet, set to go live this July with a half-dozen food industry giants, including Proctor & Gamble, Supervalu, Ralston-Purina and PepsiCo.

The Internet-based exchange is designed to allow the sharing of synchronized, real-time updates on prices and shipment information by swapping data according to XML structures set by the Uniform Code Council (UCC). The UCCnet technical standards, backers say, are intended for open use by all supply-chain exchanges so they can be linked. Although started by the food industry, UCCnet is expected to spawn exchanges to serve other vertical industries.

"These other exchanges popping up do not in any way compete with UCCnet," says Scott Williams, senior manager for global e-business development at Proctor & Gamble. "The key is to have these industries linked somehow through a common set of standards."

The virtual catalog hosted by UCCnet will push and pull data directly from corporate back-end enterprise resource planning and database systems in order to synchronize supply-chain information and flag errors before problems multiply on the production and shipping end.

"If you don't have the right trading partner data, nothing works," says Williams, who noted that about 30% of the information P&G maintains on its retailers is wrong on any given day. This is particularly true when electronic data interchange is not in use between P&G and its trading partners. EDI is the most widely used commerce technology today, although small companies tend to find it expensive and hard to use.

When there are errors, a lot of time and money is spent trying to rectify the mistakes. UCCnet is meant to automate this supply-chain process by industry through format-neutral XML, which can be mapped to EDI or other data formats.

As a creation of the UCC, a standards organization in Princeton, N.J., UCCnet brings the steady voice of an experienced business community to the business-to-business marketplace mania. Investment money is fueling hundreds of Web-based trading exchanges, many of which don't have many users.

In addition to UCCnet's first six corporate sponsors, 30 other UCC members from the food industry intend to use the exchange by year-end.

UCCnet is being built by the Bethesda, Md., firm AppNet Systems with GE Information Services, ViaLink, Sun and Hewlett-Packard, among others. The first services will track purchase order history through product shipping, receiving, billing and payment. Sometime in the future, UCCnet will take on the tougher task of online collaborative planning, forecasting and replenishment, called CPFR for short (see story, left).

Subscription access to Internet-based UCCnet will start at $1,500 per year for small companies to hundreds of thousands for industry giants. UCCnet will not charge a percentage of each sales transaction, as many exchanges plan to do.

Supervalu, which has a $20.3 billion business in food distribution as well as being an $8 billion grocery retailer, will use XML-based UCCnet to extend its electronic trading community beyond what's feasible with its installed EDI systems.

"EDI isn't dead, but it isn't going to take us far down the road," says Greg Zwanziger, Supervalu's director of e-commerce. However, his company experienced 300% growth in use of EDI in the past year and projects the same level of growth this year. "We've seen success with EDI, but we're embracing XML," he says.

XML is much easier to understand, which should

See **UCCnet**, page 146

UCCnet at a glance

Fast facts about the new online supply chain network to be launched in July:

- Will operate as a nonprofit, wholly-owned operation by the Uniform Code Council.
- 30 UCC members have stated their intent to use UCCnet, whose service costs will scale from $1,500 per year, depending on company size, with no transaction charges.
- Will be XML-based, but will also support integration with EDI.
- Six corporations from the food industry are spearheading design of the network, including Proctor & Gamble, Supervalu and Kroger, with vendor AppNet responsible for application development.

The Scoop

The news behind the news

CPFR: BUZZWORD OR REALITY?

At the Retail Systems 2000 conference in Chicago, everyone was talking about collaborative planning, forecasting and replenishment, or CPFR for short. This is the buzzword for online sharing of sales forecast data between buyer and seller for efficient production planning.

But talking about CPFR and actually making use of it are two different things, with companies struggling with pilot projects for years.

Why the difficulty? The first problem is getting upper management to buy into the idea of handing out sensitive corporate data to suppliers, data that could reach competitors if it were passed along. The second issue is a lack of CPFR standards, which means the half-dozen CPFR-style software packages available today can't share data.

Retail industry giant Wal-Mart, which had $165 billion in sales in 1999, started a CPFR pilot project almost three years ago with Sara Lee. While Wal-Mart is somewhat secretive about it, last week the strategic applications manager for the project, Bobbie Aldridge, summarized its progress for the benefit of conference attendees.

It takes considerable time to decide what information the retailer and supplier are comfortable sharing with each other, Aldridge says. "Sometimes we have information about a promotion, and we just can't share it," she says.

In the Wal-Mart/Sara Lee pilot, based on homegrown software from Wal-Mart, information was transmitted using the electronic data interchange 830 transaction set (although CPFR doesn't require use of EDI).

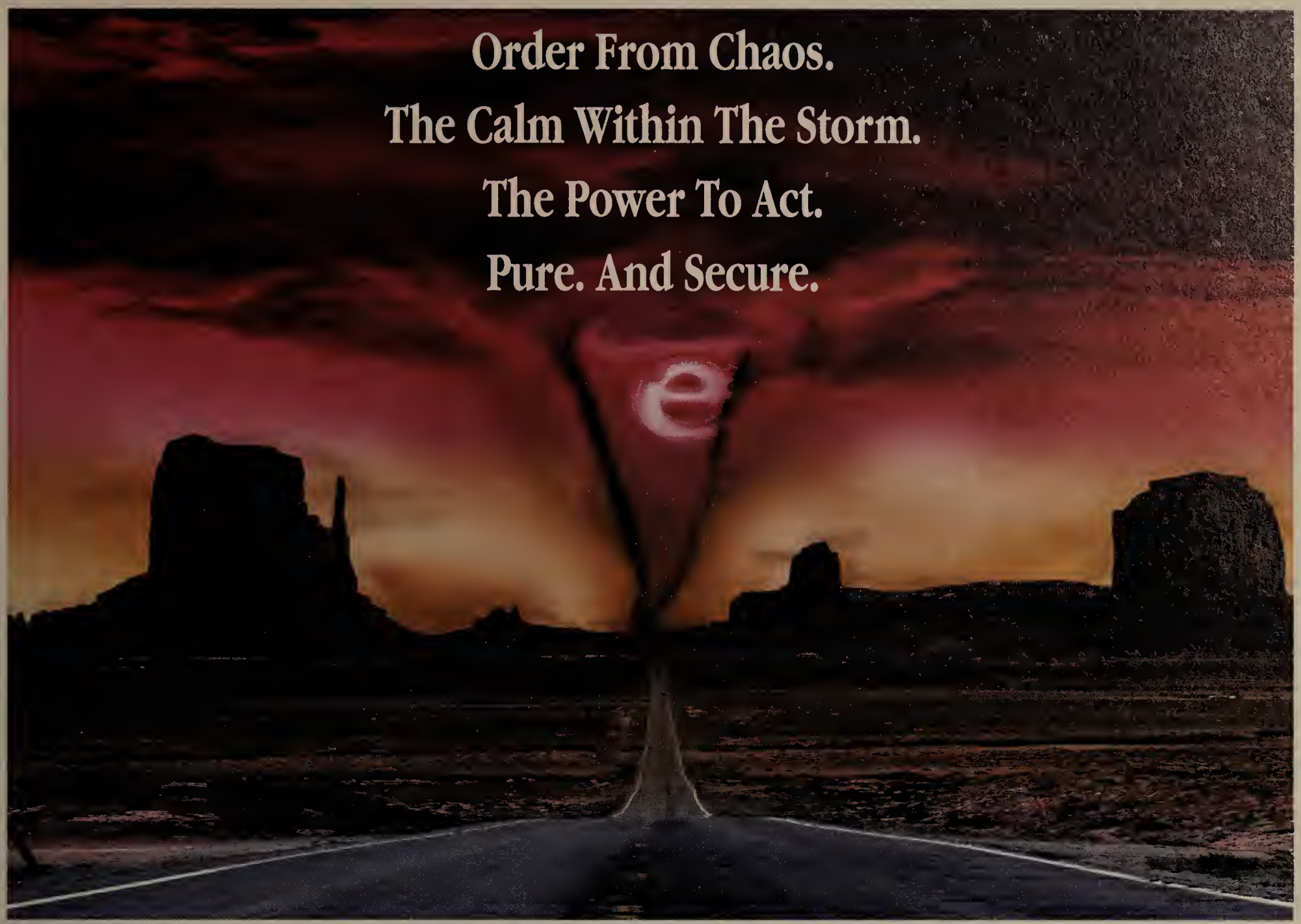
The CPFR Web site that Wal-Mart built combines sales forecasting information with production planning data sent by the supplier, so manufacturing can be adjusted when changes occur. The goal is to cut down on unnecessary inventory stock, or conversely, item shortages that Wal-Mart might face without this type of automated, careful planning.

Aldridge says the CPFR pilot with Sara Lee was shown to work, but with tremendous effort. Wal-Mart plans to involve other companies in CPFR tests, too.

Logility, GEIS, Syncra Systems, Manugistics and i2 Technologies each offer their own style of collaborative planning software. But users say none of these packages work well across vendor boundaries. "They're not interoperable," says Scott Williams, senior manager for global e-business development at Proctor & Gamble.

Corporations in the retail industry expect Voluntary Interindustry Commerce Standards (VICS), in Lawrenceville, N.J., to eventually establish standards in this area. Ron Griffen, senior chief information officer at The Home Depot and recently named chair of the VICS organization, hinted during his keynote address at the conference that VICS will have more news on that front during the next few months.

— Ellen Messmer



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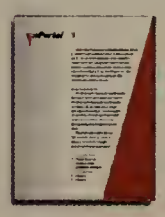

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Qwest's 'cumbersome' spinoff

Plan to give voice, data traffic in the West to another carrier isn't simple.

BY DAVID ROHDE

WASHINGTON, D.C. — Behind the scenes of Qwest Communications' pending merger with US West, Qwest officials are expecting big operational and marketing headaches when they spin off their long-distance business in the US West territory.

A plan filed earlier this month with regulators explains how Qwest will unload part of its long-distance network. The carrier acknowledges that once the US West merger closes, it "will be at a significant disadvantage to other carriers that can offer service on a nationwide basis."

And in an ominous note for users buying Qwest Internet services, the company also says its plan to hand off Internet backbone traffic in the US West region to a third carrier will be "cumbersome" and create "major operational inefficiencies for Qwest by comparison with any other Tier 1 ISP."

Qwest submitted the 111-page divestiture plan to the Federal Communications Commission on April 14 after announcing this past month it is turning over its long-distance network in the US West region to emerging carrier Touch America. The FCC has ordered Qwest not to carry any long-distance voice, data or Internet traffic in the US West territory after the merger because US West still has no long-distance authority for any of its 14 states.

Qwest said it will comply, but submitted a plan that some analysts say skates along the edge of the FCC's demands. For example, the FCC ordered Qwest to explain how it could keep its own Internet backbone operating "without originating any Internet traffic in the 14-state US West region" and demanded to know how Qwest "will dispose of Internet addresses and Web-hosting servers for their Internet customers."

But the Qwest plan says the carrier will retain all its Web-hosting services nationally — including two data centers to

See **Qwest**, page 146

Cabletron subsidiary to target MANs

BY JIM DUFFY

SANTA CLARA — Riverstone Networks, the service provider equipment subsidiary of Cabletron, is about to embark on a major push into the metropolitan-area network (MAN) market with several new products that will debut over the next year.

The products are intended to let businesses access new, high-speed IP and Internet services, and applications from their service providers. The new gear will range from 'Net appliances for small hosting sites to a new terabit switch router with OC-768 switching capabilities for MAN backbones.

New products for the shared tenant market include the RS 2100 and 3000 switch routers. These devices are designed to provide Gigabit Ethernet aggregation in a small footprint in order to free up rack space for collocation needs.

The 2100 will feature eight fixed-configuration 1000Base-SX ports. The 3000 will feature 32 10/100M bit/sec ports and two LAN/WAN expansion slots. The 2100 is shipping, now; the 3000 will ship in July.

For Web-hosting facilities, Riverstone will unveil the IA 1100 and 1200 Internet appliances in June. These devices are successors to Cabletron's SLB-1000 and SLB-2000 load-balancing switches announced last fall (*NW*, Nov. 8, 1999, page 20).

For the service provider infrastructure, Riverstone will unleash a raft of products beginning with channelized T-3/E-3 modules for its RS 32000 router later this spring. At midyear, Riverstone will unveil 2.5G bit/sec OC-48 packet-over-SONET (POS) interfaces for its RS 8000 and 32000 routers. Currently, the highest link speed on those devices is 622M bit/sec OC-12.

Riverstone will also add four- and eight-channel wavelength division add/drop multiplexing (WDM ADM) to the RS 32000 at midyear, as well as DOCSIS-compliant cable headend capabilities. The WDM ADM will enable the device to add or subtract wavelengths to or from MAN fiber. As a cable headend, the RS 3200 will aggregate multiple cable modem connections for MAN and Internet access.

In the third quarter, Riverstone will add Multi-protocol Label Switching software to the RS 8000 and 32000 platforms. This will enable service providers to engineer their networks to support IP services such as virtual private networks.

Next year, Riverstone will unveil the next generation RS switch router, a terabit-capable device supporting 10G bit/sec Ethernet and multiple OC-192 POS ports for scaling MAN backbones. ◪

Riverstone milestones

The product roadmap for the Cabletron spinoff:

Late spring
- Channelized T-3/E-3 for RS 32000.

June
- IA 1100, 1200 Internet appliances; RS 3000 gigabit aggregation switch.

Midyear
- OC-48 for the RS 8000, 32000; four-channel and eight-channel WDM, DOCSIS cable headend for RS 32000

Q3
- Multi-protocol Label Switching for RS 8000, 32000.

First half of 2001
- RS platform with terabit routing, 10G bit/sec Ethernet, OC-192 and OC-768.

Start-up turns spare PCs into VPN appliances

BY TIM GREENE

WAKEFIELD, MASS. — If you want the advantages of a 'Net-based virtual private network, but don't want the hassle of setting one up, you might give OpenReach.com a try.

From this start-up's Web site, you download software to turn spare PCs into VPN appliances and install them on the LAN at each proposed node of your VPN. After that, the VPN is pretty much ready to roll, according to OpenReach.com CEO Mark Tuomenoksa.

The service will be demonstrated at NetWorld+Interop 2000 in Las Vegas May 7-12.

All customers need is a Pentium 90-MHz PC or better as well as a dedicated Internet connection at each site.

The service, called OpenReach Service, would be ideal for VPNs among business partners, says Gagan Rastogi, network analyst with Network Strategy Partners in Boston. Ordering dedicated links requires too much lead time, he says.

OpenReach Service is also suited to staff-strapped companies that want a VPN but can't afford the training or personnel to set one up, Rastogi says.

The VPN-enabled PCs create IP Security (IPSec) architecture tunnels when traffic is sent to any of the other nodes, OpenReach.com says. Otherwise, if traffic is going to a Web site on the Internet, it is sent unencrypted.

The OpenReach.com network operations center (NOC) assigns each PC an IP address and distributes a list of all other PCs on the network. They use digital certificates to identify themselves to each other, and OpenReach.com acts as the certificate authority.

Private encryption keys are generated by each OpenReach-enabled PC, Tuomenoksa says. He claims that is done in such a way that not even OpenReach.com's key exchange has access to the private keys. The process is patent-pending, and Tuomenoksa declined to give details.

Customers can also access the NOC via a Web browser and get reports on latency between sites. That information can be used to check service-level agreements customers may have with ISPs.

OpenReach software includes a Linux-based operating system and supports IPSec tunnels and Triple-DES encryption. It also includes a firewall that the company intends to make compatible with those made by major firewall vendors.

Downloading the software is free, but the service costs $100 per month for a site connected to the 'Net by a 384K bit/sec link. The service costs $300 per month for connections between 384K bit/sec and 4M bit/sec. Anything above that speed costs $1,000 per month. Rastogi says a 'Net connection plus a VPN service from a service provider would cost more.

OpenReach Service will be available in June.

OpenReach.com: www.openreach.com

PROFILE: OPENREACH.COM

Headquarters:	Wakefield, Mass.
Founded:	December 1999
Service:	Online VPN service called OpenReach Service.
Competitor:	SmartPipes
Funding:	$15 million, Polaris Venture Partners
Employees:	35
Fun Fact:	CEO Mark Toumenoska is also a professional keyboard and saxophone player.

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Edge aims to tame mgmt. duties

BY MARC SONGINI

NETWORLD+INTEROP 2000 PREVIEW

Companies looking to create a single management console for their networks may want to consider new portal software from Edge Technologies.

The Fairfax, Va., network management software firm is expected to announce the rollout of enPortal at the upcoming NetWorld+Interop 2000 in Las Vegas. This product will take data and technology from disparate network management vendors and consolidate the information on one customizable graphical user interface that can be accessed via a Web browser.

Users will be able to perform tasks such as troubleshooting problems and ensuring quality-of-service levels are being enforced without having to jump through multiple screens, Edge says.

A unique view

With enPortal, unique views of the network can be crafted for individual users, depending on the information they need. The portal can monitor the network in real time by geographic topology, business process or applications, Edge says.

The portal can also integrate data from different management products, such as Hewlett-Packard's OpenView or Concord's Network Health tools, and report that data to IS staff.

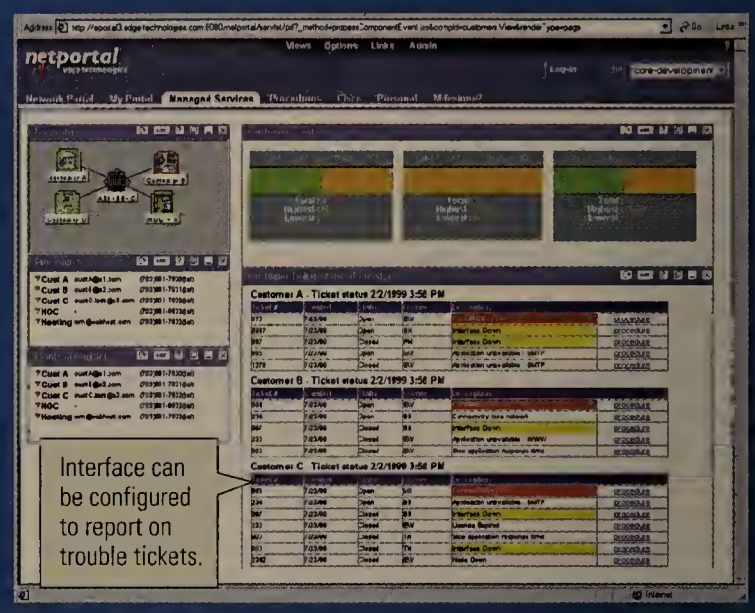
EnPortal will have a workflow engine feature to automate standard procedures. For instance, if a particular router needs to be configured in a special way, the step-by-step process of doing it is recorded in enPortal's database. Any employee needing to configure that router will then have an automated set of steps to take, which will save training time for IS staff.

The competition

Edge is not alone in the net management portal arena, says John McConnell, principal at McConnell Associates, a consultancy in Boulder, Colo. At least one other company, Manage.Com in San Jose, has been offering portal products for the past year, he says. However, the workflow engine sets Edge apart, and if delivered effectively would be highly valuable to users, he says.

Edge's enPortal

This Web-based product combines data from hetergeneous management platforms into one display. Users can troubleshoot and ensure quality-of-service levels without jumping through multiple screens.



This is a product that could result in productivity gains for large enterprise networks, says Michael Lanier, chief information officer of Rhythms NetConnections, a provider of broadband connections. Lanier is in the process of beta-testing enPortal in his Denver network. He believes his users will be able to combine network management processes and views in ways never before possible.

EnPortal will be available next month for Windows NT initially, and later for HP-UX and Solaris. Pricing starts at $55,000.

Edge Technologies: www.edge-technologies.com

New forum to set wireless multimedia directions

BY JASON MESERVE

A group of industry heavyweights this week will band together to decide how to best deliver multimedia content to wireless Internet devices.

The Wireless Multimedia Forum (WMF), a consortium of 16 vendors including PacketVideo, Cisco and Nortel Networks (see graphic), will meet in San Jose to begin defining how to help content creators author rich media such as audio and video presentations once and deliver it to any IP-ready wireless device.

Conspicuous by their absence are the leaders in streaming media technology: RealNetworks and Microsoft. Martin Hall, chief technology officer of Stardust.com, the company that is managing the forum, says that in the rush to get the forum up and running, these companies have not yet been approached, and it is just a matter of time before they're asked to get involved.

"By using different format types you create a subset of noninteroperable devices, and no one wins in that situation," Hall says. "The bottom line is we don't want to have a fragmentation of standards for wireless multimedia delivery."

Hall emphasizes that the WMF will not be a standards-creating body. The group will work with the WAP Forum, Internet Engineering Task Force, World Wide Web Consortium and others to come up with the best approach for handling rich media.

Founded by PacketVideo, a company dedicated to delivering multimedia content to wireless devices, the WMF will choose which existing audio and video compression standards are best suited for a wireless environment and recommend their use to wireless carriers, service providers and device manufacturers. Hall expects that the MPEG4 digital video standard will be a major point of discussion at this week's meetings.

Iain Gillott, an analyst at Framingham, Mass., market research firm IDC, predicts the number of wireless devices connected to the 'Net will be three times greater than the number of PCs connected by the end of 2002, resulting in more than 100 million wireless Internet devices in the U.S.

Wireless Multimedia Forum

The WMF was formed to act on the following issues:

- Agree on audio/video compression protocols for wireless devices.
- Develop quality-of-service initiatives.
- Determine billing, security and copyright conventions.
- Increase the usefulness of mobile networks.

Charter members of the WMF include:

- PacketVideo
- Cisco
- Nortel Networks
- Samsung
- GEO Interactive Media

Maxspeed, Corel team for Linux project

BY APRIL JACOBS

Maxspeed and Corel are teaming to offer a package that combines the administrative simplicity of thin clients with the reduced software costs of the Linux operating system.

Under an OEM agreement announced this past week, Corel will bundle its Corel Linux operating system and WordPerfect Office 2000 for Linux with Maxspeed's desktop devices, which include thin clients, PC sharing devices and terminal-like desktops.

What's interesting about the Maxspeed-Corel combination is it lets users set up a single PC running the Corel Linux operating system that can be accessed by multiple thin clients.

Because thin clients require far less administration than PCs, the stations would be ideal for retailers or those with call centers that have multiple sites where end users are running a fixed number of applications. Those applications could be loaded on the PC and shared and maintained in a single location.

"If you take Corel Linux — which is easy to use and has lots of productivity interfaces that a lot of people are familiar with — customers can use the tools and not have to know what the operating system is," says Dan Kusnetzky, an analyst with IDC, a market research firm in Framingham, Mass.

Kusnetzky points out that the combination of inexpensive and reliable hardware from Maxspeed and Corel will for some customers present an attractive alternative to PCs running Microsoft Windows.

See **Maxspeed**, page 152

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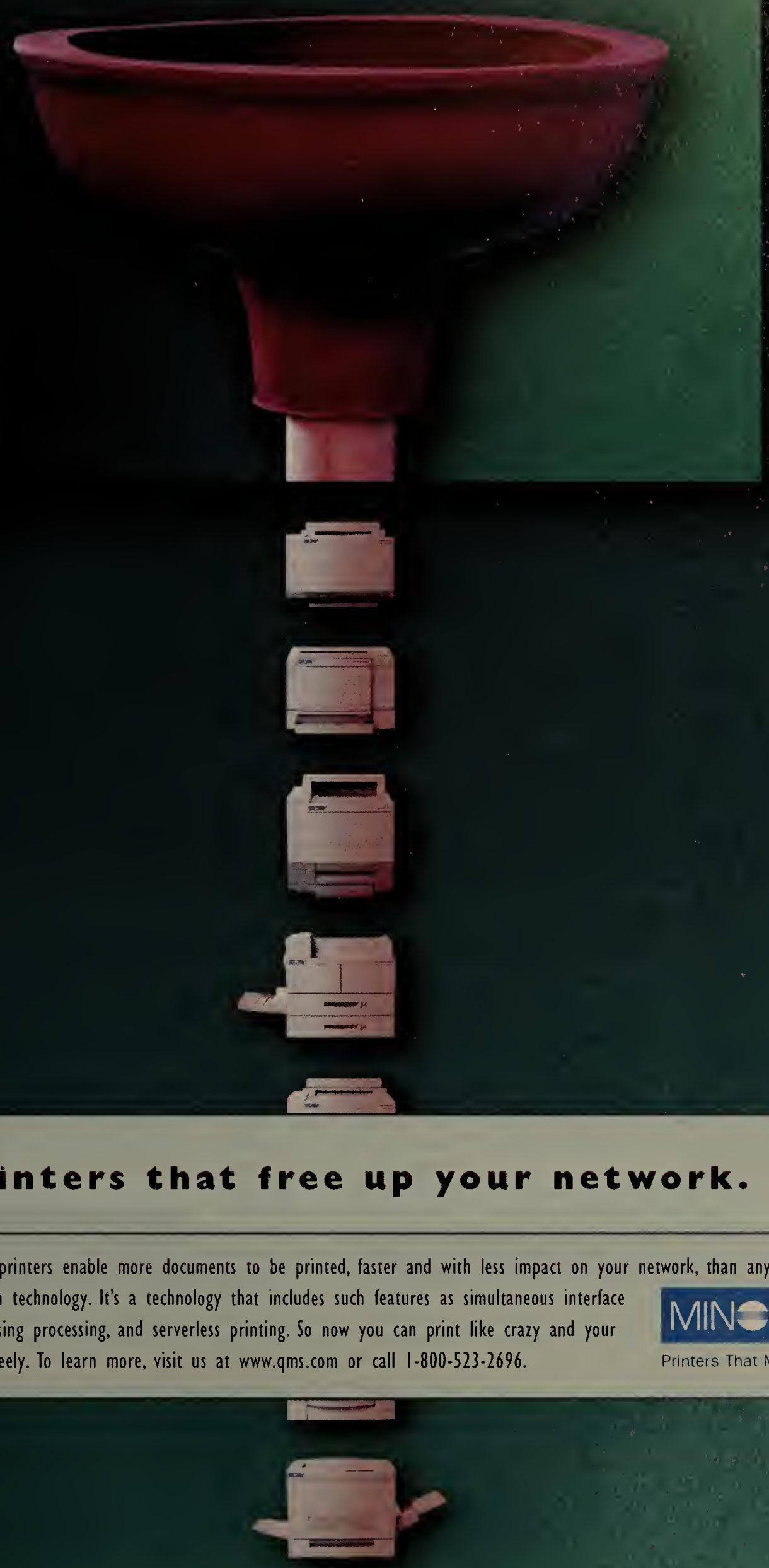

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Pocket PC looks to exploit new markets

Microsoft's latest entry in handhelds takes aim at high and low ends.

BY JOHN COX

Microsoft may be trying to do an end run around arch rival Palm Computing with the new Pocket PC it unveiled last week.

Palm rules the palm-sized handheld market among white-collar workers. Microsoft seems to be aiming the Pocket PC at two groups that so far remain virgin territory: sophisticated multimedia zealots and technically unsophisticated workers who need a simple way to access corporate data.

Blue-collar computing

One example of the latter is an inventory tracking system created by FinTech Services, a Calgary SAP systems integrator, for Husky Oil, an exploration and production company. In four weeks, FinTech built a program to run on the PTT 2700 Pocket PC handheld from Symbol Technologies, which specializes in rugged handhelds for vertical markets.

At a remote Husky site, workers pull a spare pump from a shelf and scan its label with the 2700's bar-code reader. A built-in radio links to a wireless LAN, and then to Husky's WAN. At headquarters, the inventory change is routed to an enterprise resource planning system at one of five suppliers. The suppliers can arrange delivery before there's a "stock out."

"In the oil industry, a 'stock out' situation can cost you a lot of money," says Michael Finch, FinTech's director of mobile computing solutions. Just minutes of training were needed to have employees using the Pocket PC application, he says.

The Pocket PC handhelds are "Windows-powered," as Microsoft coyly puts it, dispensing with all reference to the handheld's operating system, which is in fact the latest version of Windows CE. It's getting good reviews.

Symbol's PTT 2700 handheld companion features the Microsoft Pocket PC operating system.

"They have dramatically simplified the user interface," says Diana Hwang, an industry analyst with market research firm IDC in Framingham, Mass. "And performance is a lot better, both for applications and for ActiveSync [which synchronizes data between the handheld and a user's PC]."

So far, four hardware vendors — Casio, Compaq, Hewlett-Packard and Symbol — have unveiled new devices with color displays based on Pocket PC software.

Prices are mostly in the $399 to $499 range. Symbol's single-unit price is about $1,000, which includes the wireless link, the bar-code scanner and a sealed, protected case. Palm products range from $249 to $449.

Microsoft has created a stack of software to support Pocket PC, including "pocket" versions of widely used Office applications such as Outlook, Word and Excel. A big addition is the pocket Internet Explorer, which automatically resizes a Web page to fit the handheld's screen.

Third-party software and hardware options will be critical to the success of the Pocket PC in enterprise markets. Socket Communications offers a set of CompactFlash-sized adapters to connect Pocket PCs to mobile phones, Ethernets, and Universal Serial Bus and serial-compatible peripherals. Arcot Systems ported its WebFort "strong authentication" security software, which adds to the Secure Sockets Layer and 128-bit browser encryption that are part of the Microsoft software.

Casio's models show the range of markets being attacked. One model is aimed at the "mobile professional." Another is aimed at users who want to be able to play digital content. Other models will be designed for specific industry and business markets.

A separate series, the Casio EG models, are aimed at vertical industries and specific business applications. ◪

Bell Atlantic cooking up metro fiber

Channel Extension Service supports up to 1.25G bit/sec.

BY TIM GREENE

NEW YORK — Bell Atlantic is quietly rolling out a high-speed optical service for connecting sites in metropolitan areas at speeds up to 1.25G bit/sec.

Called Channel Extension Service, it provides customers with dedicated point-to-point links for critical traffic based on virtually any protocol.

So far, Bell Atlantic has been selling the service to customers in the New York and New Jersey areas on a custom bid basis. Advertising has been word-of-mouth.

Pricing will be revealed this fall when the company plans to tariff the service. At that time, it will be available throughout the Bell Atlantic territory from Maine to Virginia, says Oscar Mujica, a Bell Atlantic product manager.

The alternative service would be multiple slower links.

The carrier sets up the service by installing an Adva Optical Fiber Service Platform (FSP) or InRange Technologies' OptiMux at customer sites. Customers need optical cards on their local switches or routers and must plug them in to a port on the optical gear.

The optical equipment supports FDDI, ATM, Enterprise Systems Connection, Fast Ethernet, Gigabit Ethernet, OC-3, OC-12 and OC-48. It also works with STM-1, STM-4, STM-16, Fibre Channel, FICON and coupling link.

The FSP and OptiMux can route traffic to alternate paths in case of a fiber break. Both can perform wave division multiplexing, so if customers needed more than one wavelength to carry their traffic, they could add it to their existing fiber connection. The gear can multiplex up to 32 wavelengths on a single fiber pair.

Mujica says customers have been using the service for connecting Gigabit Ethernet LANs or linking remote sites to mainframes in data centers. The service is also suitable for mirroring data across sites, he says.

The equipment can support services between sites that are up to 49 miles apart.

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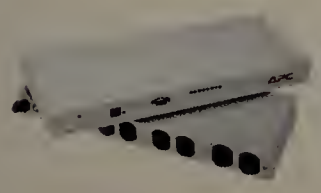

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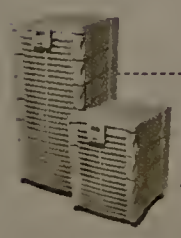

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Briefs

Computer Network Technology has rolled out IP network capability for its storage-area network (SAN) products. Two of CNT's UltraNet Open Systems Directors are now able to transmit data over the Internet using software dubbed SAN Over IP. SAN Over IP is designed primarily for backing up network data, data replication, warehousing or to make underutilized storage available.

The software takes the SCSI or Fibre Channel data received from the network, encapsulates it in an IP data packet and sends it to an IP router for transfer over the Internet.

SAN Over IP will be available this month at a starting price of $20,000.

CNT: www.cnt.com

Last week, **BMC Software** announced products that will let customers manage and monitor SANs using the firm's flagship Patrol platform. BMC also said it would offer SAN consulting and implementation services.

First, BMC is shipping a new module, called Patrol for Storage Management, which gives customers a single view of SAN devices.

The module, which sells for $8,500, will let users monitor EMC's Symmetrix line of storage hardware for performance and disk space. BMC says it will extend Patrol support to other vendors' hardware. Among them will be IBM's Enterprise Storage Server, known as Shark, and Compaq's StorageWorks.

Later this year, BMC is planning to offer an as yet unnamed SAN management software that will let customers discover SAN devices, and create maps of SAN topology and resources. The SAN management software will start at $5,000.

BMC: www.bmc.com

Alcatel and Funk tighten LAN security

BY TIM GREENE

CALABASAS, CALIF. — Alcatel is making it possible to keep unauthorized LAN users out of resources where they don't belong with a custom security package from Funk Software.

The package uses Remote Authentication Dial-In User Service (RADIUS) to give network professionals the ability to create logical workgroups and virtual LANs, even when those users are spread out on different LAN segments.

While RADIUS is generally used for authentication of remote users, this application instead authenticates users on a LAN as they try to gain access to LAN ports on Alcatel OmniSwitches.

Alcatel had tried to provide similar features for its OmniSwitches using software from Check Point Software, but Check Point required its own database of user profiles, Alcatel says.

Alcatel switched to Funk's Steel-Belted RADIUS software because it supports other directories, including Windows NT directories, Novell Directory Services and Lightweight Directory Access Protocol. Steel-Belted RADIUS saves administrators headaches by making use of these other directories rather than requiring that new ones be built from scratch. Funk had to tweak its software to accommodate proprietary Alcatel directories, Funk says.

Steel-Belted RADIUS also supports security tokens such as RSA Security's Secure ID. With the Funk software, when a user attempts to access a particular server through an OmniSwitch, Funk's Steel-Belted RADIUS challenges the user for name and password. The software checks with a RADIUS directory to determine what LAN resources that user is authorized to access. The RADIUS server informs the switch which virtual LANs the user's media access control address is allowed to access. If the server is among those resources, the user gets access (see graphic).

This is a unique use of RADIUS that makes it relatively simple for network administrators to add authorization to LAN security, says Pete Dailey, a managing partner of analyst firm Frost & Sullivan. Dailey says he expects other switch vendors might form similar alliances with Funk or other RADIUS vendors.

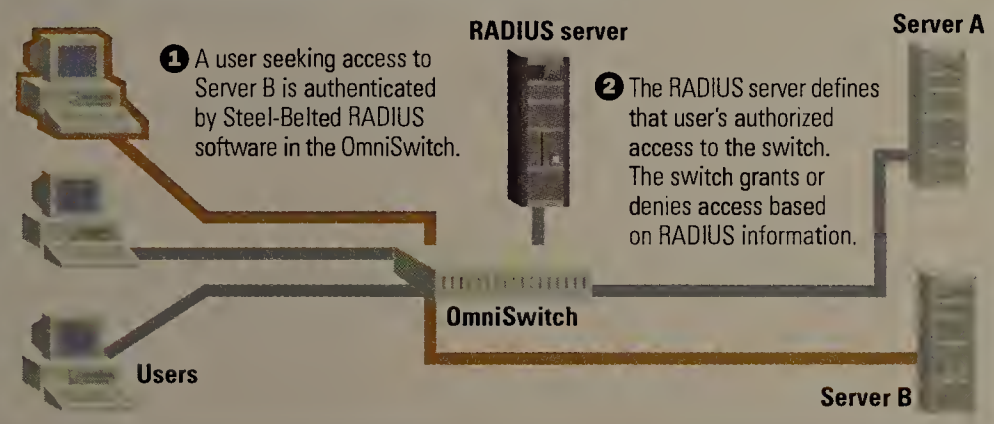
This scheme contains more security features than a standard being considered by the IEEE. That standard authenticates users to a switch but allows them free access to the whole enterprise beyond the switch, Alcatel says. RADIUS can restrict what parts of the enterprise each user has access to.

The software is sold with the OmniSwitches as a separate option and costs $300 to $800 extra, depending on which OmniSwitch model is used.

Alcatel: www.alcatel.com; Funk: www.funk.com

Lock down your LAN

Alcatel and Funk Software are teaming to put Funk's Steel-Belted RADIUS software on Alcatel OmniSwitches to restrict access on LANs.



CacheFlow takes aim at e-commerce

BY APRIL JACOBS

Looking to give users an easier way to distribute Web content, cache device maker CacheFlow last week debuted its CacheOS/s operating system, aimed at e-commerce applications.

CacheOS/s uses technology gleaned from CacheFlow's recently announced alliance with content distribution company Akamai. For example, Akamai's Akamaizer software will be an option for CacheOS/s users. Akamaizer lets customers place popular content in key regions on the Akamai network. Akamaizer will for the first time let CacheOS/s users automate the placement of content on the Akamai network based on policies set by a network professional.

CacheOS/s is a stand-alone software product separate from CacheFlow's existing CacheOS software and has features not found in the existing product, such as the content distribution.

The new software also gives net managers the ability to place content on a network without recoding the contents — a time-consuming process in some cases. "A key advantage of using [CacheOS/s] is that you alleviate congestion across the firewall," says Peter Firstbrook, an analyst with Meta Group, a consultancy in Stamford, Conn. "And because you are serving more content from the cache, you don't need as many Web servers on the back end, which is another cost savings."

CacheOS/s runs on cache devices that sit in front of a Web server farm, typically behind a Layer 4 switch. CacheOS/s is designed to deliver content that is considered static, such as graphics.

The software is integrated with CacheFlow's appliances with no additional license charge and will be available on June 1. CacheOS/s with the Akamaizer software is priced from $9,995 to $14,995, depending on configuration.

CacheFlow: www.cacheflow.com

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Start-up puts an edge on caching

BY DENI CONNOR

The Internet is the slowest link when it comes to caching content for large corporate networks and ISPs — at least that's what the founders of start-up service provider Edgix are counting on.

Edgix's product, edgeMedia, taps a broadband satellite network to transmit caches of data to speed the delivery of Internet content to users, a technique dubbed "edge caching." Other companies, such as Cidera (formerly SkyCache), have similar products.

Two of the original developers of Novell's NetWare, Drew Major and Kyle Powell, established the firm in December 1998. A third founder, Mark Hurst, is known for his early work with WordPerfect.

PROFILE: EDGIX

Founded:	December 1998
Product:	EdgeMedia, a service for speeding the delivery of Internet content using caching and satellite technologies.
Key officials:	Rangu Salgame, CEO; Drew Major, board member; Kyle Powell, chairman; Mark Hurst, CTO.
Funding:	Over $15 million from Venrock Associates, Battery Ventures and Novell.
Fun fact:	Founded by two of the original developers of Novell's NetWare.

EdgeMedia uses Novell's ICS to cache data locally at its sites and at customer locations. A master cache, located at one of Edgix's global network operation centers in the U.S., Canada, the Caribbean and Latin America, gathers frequently accessed data and stores it in cache.

CacheAdvisor, specialized Edgix software, delivers the cached data to a data store located at the company or an ISP via broadband point-to-multipoint satellite transmission. Once data reaches the local cache, which is one hop away from the user, it is delivered to the customer over the corporate network, digital subscriber line, cable modem or dial-up lines. A satellite disk, receiver and caching appliance comprise the local cache at the customer location. Edgix has initial agreements with Dell and Compaq to use their caching appliances. If all satellite transmission fails, the terrestrial Internet steps in as a last resort.

Using broadband satellites for data transmission allows CacheAdvisor to bypass the Internet, speeding delivery of Web content up to 45M bit/sec, the company claims.

"Today, we use caching in Germany where Internet access is not 'all you can use' for the same price — they still charge a per-megabyte service charge," says Chip DiComo, a network manager for Hellman Worldwide Logistics, a worldwide shipping company in Miami. DiComo uses caching at the company's global sites and says he may find edge caching useful. "We have latency issues, primarily in South Africa because data between Miami and South Africa is more often than not taking a convoluted path, causing delays," he says.

EdgeMedia is in beta testing now and is expected to ship by midsummer.

Edgix: www.edgix.com

Wired Windows . Dave Kearns

MICROSOFT AD LEAVES A BAD TASTE IN EVERYONE'S MOUTH

If you watch television at all, by now you've seen the Microsoft ad in which Bill Gates, wearing his "regular guy" clothes, spins a 30-second fairy tale about his company.

In a typical once-upon-a-time opening, Gates intones: "Twenty-five years ago, my friends and I started with nothing but an idea that we could harness the power of the PC to improve people's lives."

Bill, Bill, Bill. What happened to truth in advertising? Twenty-five years ago there was no PC. Twenty-five years ago you sought to make a quick buck by selling a compiler for the basic language. Then you launched a career of being an inverse Robin Hood — taking ideas from cash-poor developers, then keeping the money you made from their efforts. Along the way, you rode roughshod over most established standards bodies while playing the spoiled brat in your dealings with partners and competitors.

The ad continues with Gates stating: "Now our goal at Microsoft is . . . to keep innovating . . ." What innovating? In 25 years, there have been no innovations emanating from Redmond — unless you count "Microsoft Bob." Every new product, every new idea was originated and developed somewhere else before being exploited by Microsoft.

Take your billions and get out of the way. Let the company settle with the Department of Justice and get on with business. Stop telling fairy tales to the computing public. Then, maybe, we can all say " . . . the best is yet to come."

On a more upbeat note, last month I mentioned a rumor going around that Novell CEO Eric Schmidt and Chief Operating Officer Stewart Nelson didn't get along. Well, at least according to Nelson, nothing could be further from the truth. According to Nelson, the two are so compatible that when Schmidt eats Tex-Mex, Nelson gets heartburn.

He also claims to have no desire to leave the Novell fold to strike out on his own, nor does he aspire to replace Schmidt at the top. That's a good idea, since Novell shows little history of promoting from within. Only time will tell, but Nelson has shown great survival instincts since coming to Novell from WordPerfect, so I wouldn't bet against him now.

Kearns, a former network administrator, is a freelance writer and consultant in Austin, Texas. He can be reached at wired@vquill.com.

Tip of The Week

If this column's been too heavy for you, take a break and check out the request for comment for a new IP, which was published April 1. ftp://ftp.isi.edu/in-notes/rfc2795.txt suggests a new way to measure the results of an age-old problem.

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Briefs

Like many U.S. carriers, **British Telecom** is considering separate tracking stocks or spinoffs for some of its businesses. For example, BT announced it will establish a separate stock listing for a U.S. telephone-directory publisher it bought last year and will consider such moves for its Internet access and wireless divisions. BT, whose overall stock price took a dive in February after it reported earnings pressure due to domestic competition, is AT&T's partner in building a global voice and data network.

State regulators will begin to take the lead in resolving cases of "slamming" — the practice of changing a business's or consumer's long-distance carrier without the customer's explicit authorization — under new rules approved by the **Federal Communications Commission.**

The move is an attempt to break a logjam over slamming regulation after a court stayed some federal slamming rules and the telecom industry failed to agree on an expected third-party administrator to adjudicate slamming cases. A trade group for state regulators has identified 35 states in which the state government has agreed to take on slamming enforcement; the FCC will handle cases from the other states.

Two early providers of voice over digital subscriber line (DSL) are going to become one, as **Mpower Communications** has agreed to buy **Primary Network Holdings.** Mpower picks up 60 salespeople as well as expertise in DSL, other forms of dedicated access and Web hosting. Both offer multiple voice channels on a single DSL line to connect customers to regular local and long-distance phone services.

U.S. claims nations impede competition

BY DAVID ROHDE

WASHINGTON, D.C. — International telecommunications prices may be falling, but the U.S. government is not satisfied that all its trading partners are doing all they can to spur voice and data competition.

In a report to Congress earlier this month, U.S. Trade Representative Charlene Barshefsky cited nine countries for failing to implement at least one part of the landmark 1998 World Trade Organization (WTO) telecom agreement.

Barshefsky's report included some surprising names, such as both of the U.S.'s NAFTA partners — Canada and Mexico — plus large Western European countries such as Germany and Great Britain.

Getting included in the report didn't mean that the U.S. saw the target country as doing everything wrong, only that it was lacking in at least one area. For example, regarding Great Britain, Barshefsky's report said only that her office was unhappy that British regulators have given British Telecom an effective monopoly over digital subscriber lines until July 2001.

And in Canada, Barshefsky said, a universal service program could provide "unfair subsidies" to certain carriers.

Barshefsky's office identified much more serious problems in other countries. In Mexico, the report charged that the dominant carrier, Telmex, simply denies the use of interconnection trunks to competitors and added that the government has failed to fix the rules. In Japan, Barshefsky's office said dominant carrier NTT's interconnection rates are two to five times higher than in comparable markets.

Among other countries, the U.S. charged that Germany's licensing fees for competitors are too high; that Taiwan's licenses include unfair exclusivity clauses; that South Africa's dominant carrier began denying circuits to competitors last year; that Peru's dominant carrier has not been charging fair interconnection rates; and that Israel has been charging excessive access fees on calls to and from the U.S. and Canada.

The report laid out deadlines to address the problems (see graphic). Barshefsky has the option of filing a formal complaint with the WTO if the problems aren't resolved by those deadlines.

MCI WorldCom in particular has urged Barshefsky to consider filing a WTO complaint against Mexico because MCI WorldCom claims its Mexican joint venture, called Avantel, has foundered due to Telmex's intransigence.

The clock's ticking

The office of the U.S. Trade Representative gave the following deadlines for "further review" of the telecom problems it identified in other countries:

June 15: Germany, South Africa, Great Britain

July 28: Japan, Mexico

Oct. 2: Canada, Peru

Israel and Taiwan have already agreed to address the problems identified.

SOURCE: OFFICE OF U.S. TRADE REPRESENTATIVE, WASHINGTON, D.C.

DSL carriers seek free use of phone wires

BY TIM GREENE

It looks likely that the cost of setting up digital subscriber line circuits will drop thanks to technology known as line sharing.

DSL carrier Rhythms NetConnections has cut an interim deal to use US West phone lines for free when Rhythms sets up DSL phone services in Wisconsin.

While that deal is eye-popping, other carriers have agreed to pay $5.40 per month as the interim price, about a quarter of the $20 to $25 competitive local exchange carriers (CLEC) pay now to use phone lines owned by regional Bell operating companies (RBOC).

That is a significant saving on a service that retails for $60 or so per month. Carriers could pass the savings on to customers. Whether they will is still up in the air because the final cost of line sharing has not been set yet.

Line sharing is the practice of one carrier running high-speed DSL service on a phone line while a second carrier supplies regular phone service on the same line. CLECs argue that since the lines are already in place and DSL doesn't disrupt the phone service, it costs RBOCs nothing to share the line so CLECs should pay nothing.

The agreement between US West and Rhythms is just good until the end of 2000. After that, Rhythms has to pay $8.25 per month until state regulators set a price for line sharing. Then, depending on the price set, Rhythms will either get a refund or pay US West more for lines it shares.

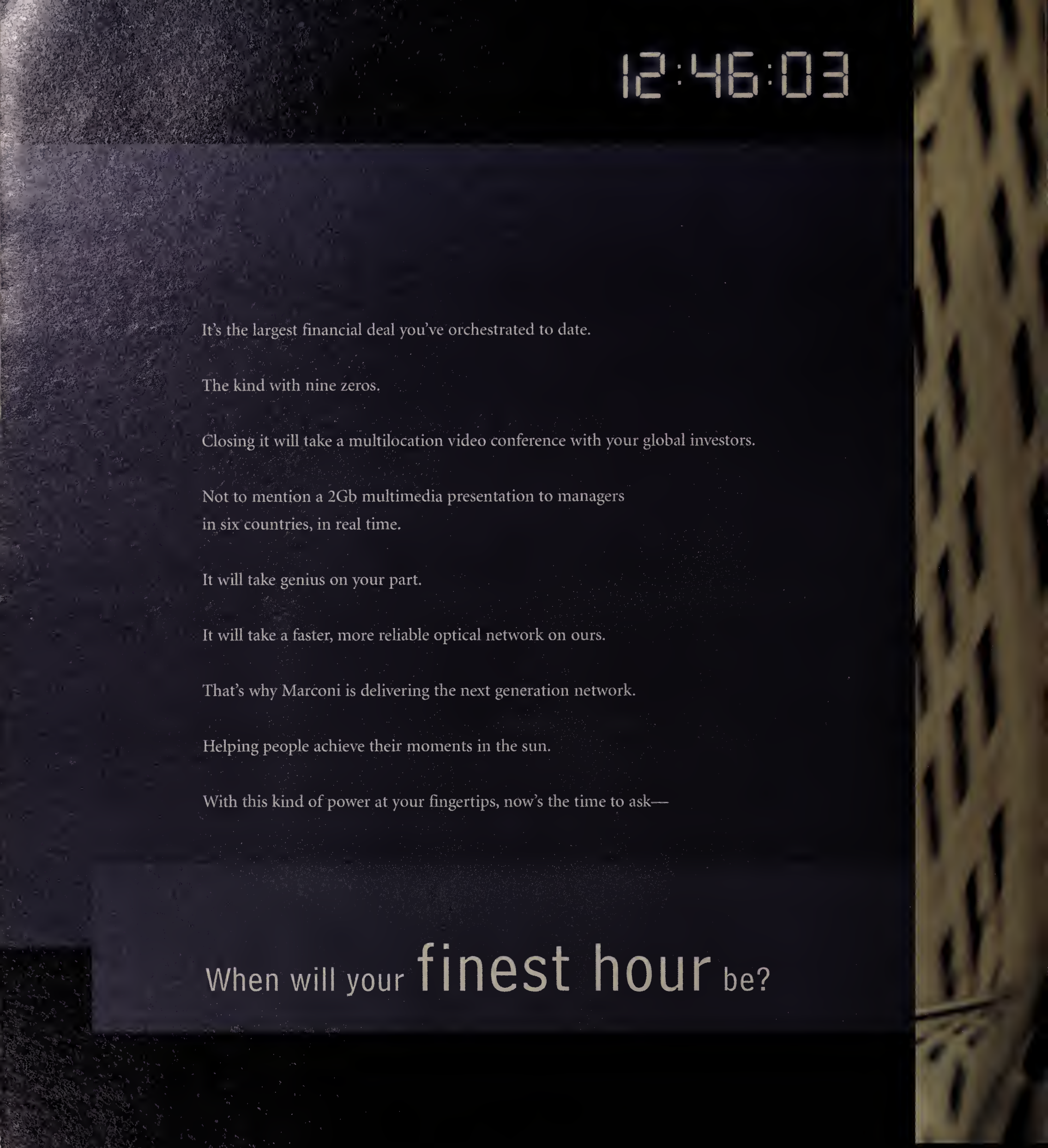
State regulators around the country are holding hearings to determine what the actual costs are to RBOCs and to set a price in each state that RBOCs are allowed to charge.

Low-cost line sharing should encourage more aggressive DSL deployment because it is a dramatic improvement in the business case for DSL CLECs, says Strategis Group, a networking analysis firm in Washington, D.C.

The Rhythms-US West agreement is more symbolic than concrete because while the companies have agreed to the price, they have not actually agreed to how they will carry out line sharing. Even so, it is a good sign, says Strategis, and there are others.

For example, Bell Atlantic acknowledges in a New York filing that its actual cost of line sharing is zero, a significant admission, according to Dean Hardt, senior counsel for DSL CLEC Covad Communications.

It will be hard for Bell Atlantic to argue for any fee for something that costs them nothing, Hardt says.



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Wan Monitor . Daniel Briere and Christine Heckart

"Whhaazzuuhhp" with Broadband Wireless?

Unless you've been working too hard, you've heard a few funky fellows muttering this on a TV beer commercial or heard guys in your office screaming it to each other between cubicles. If you are really with it, you may have seen the Superfriends e-mail with Batman, Superman and even Wonder Woman pondering, "Whhhhaaaazzzzzzzuuuuuuhhhhhhp?"

You may think this sophomoric salutation is about beer. But our crack TeleChoice research team found out that everyone is actually asking, "What is up?" with broadband wireless. Our team reports there is a lot "up" with broadband wireless, and you should start paying attention because this market is finally about to live up to its hype.

The biggest thing up is the share prices of some of the major players (granted, before the Nasdaq's most recent troubles). Two of the biggest gainers over the past 12 months are Netro and Nextlink, up more than 900% and 400%, respectively. Netro, an equipment maker, has only been public since August. Others, such as WinStar Communications and Teligent, are up over 150%. Their lofty valuations are not for their current revenue streams, but for the tremendous possibilities broadband wireless has to provide substantial chunks of bandwidth for a fraction of the landline cost.

Remember when we were teenagers, the hip phrase was, "What's going down?" In the broadband wireless space, "what's going down" is the cost of customer premises equipment. CPE costs for wireless service are rapidly dropping and are now cracking the $1,000 mark. MCI is currently testing its broadband wireless system and estimates CPE cost around $300 to $400 per subscriber.

Also going down could be your network access bills. Broadband wireless providers are pricing 15% to 40% lower than their land-based competitors for comparable service. They can also install service much faster because they avoid the incumbent local exchange carrier's slow process of installing or provisioning circuits. One provider of broadband wireless, Tachyon, will have you up and running within two weeks from the time you place your order.

The final element that is "up" can be your network's redundancy. If it is critically important for you to be always connected to the Internet or WAN, don't run the risk of "backhoe failure." A wireless connection never succumbs to this dreaded outage because it has no wired connections for the hard hats to cut. This makes broadband wireless an ideal disaster recovery solution for an enterprise that makes its living from an Internet connection.

A broadband wireless provider will target you if you are a midsize business or location. That is, your bandwidth needs are greater than a digital subscriber line or T-1, but less than a DS-3. If you are not on a fiber ring (like 95% of all businesses), wireless is a great way to get a bunch of bandwidth.

Briere is CEO and Heckart is president of TeleChoice, a market strategy consultancy for the telecommunications industry. They can be reached at dbriere@telechoice.com and checkart@telechoice.com.

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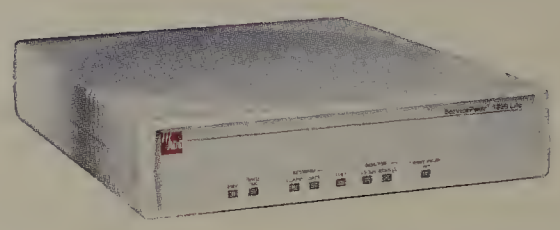

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Briefs

IBM has announced an e-business-friendly version of its DB2 database. Version 7 will support high-speed Web searches that can retrieve data 10 times faster than competitors' offerings, IBM claims. The software will support XML and include data warehousing and online analytical processing features. The product, which will be available within two months, will run on Windows 2000 and Unix. Pricing information was not disclosed.

IBM: www.ibm.com/software/data/launch

Compuware is rolling out EcoProfiler 2.1, which will let IS managers and developers stress test Web and business applications. Version 2.1 takes sample snapshots of customer relationship management, e-mail or Web applications being run on a test machine. EcoProfiler then examines the software for things that could affect its performance, such as CPU usage on a server, and indicates potential failure points. The tool will also predict the effects of adding users or bandwidth to applications. EcoProfiler 2.1 runs on Windows NT and is available now. Pricing starts at $27,500.

Compuware: www.compuware.com

Securant Technologies has shipped ClearTrust SecureControl 4.0, Unix-based proxy software to provide restricted Web-access control to Unix, Windows NT, mainframe servers supporting Web sites or other applications. Version 4.0, priced at $20 per user, adds a threat-detection mechanism to report suspicious or unusual behavior, and lets managers take actions such as suspending accounts.

Securant: www.securant.com

Allowing the Web to be heard

BY JOHN COX

Stardate 20000424.6

Captain Kirk: *"Computer. Scan all relevant data for this quadrant and plot a course to the nearest Class M planet with a Starbucks coffee store."*

Computer: *"Scanning . . . course plotted. ETA 1.13 solar days at standard warp speed."*

Mr. Spock: *"Fascinating."*

Captain Kirk: *"Maximum warp, Mr. Sulu."*

The real world is finally catching up with Hollywood.

A growing number of vendors are introducing software to let people talk to information sources, including the Web. The software listens to a voice command, converts it into a database query or HTML request and speaks the results back to the caller.

For now, users of this technology are limited to wired or wireless telephones. What's missing is a class of hands-free devices that can handle two-way voice interaction while displaying information on a larger screen used by today's personal digital assistants, such as the Palm V.

Accessing the Web by voice is the newest wrinkle in voice network technology. Lucent Technologies in Murray Hill, N.J., is testing what it calls a phone browser, which lets callers navigate a Web page and access links.

More common is the growing use of existing voice technology to let callers such as customers and employees access information in corporate databases.

United Airlines, for example, uses software from SpeechWorks International in Boston to let passengers call for flight information and report and track lost baggage. A separate voice system lets United employees book their own seats on the airline's flights. In each case, the data is pulled from United's mainframe systems and converted into speech.

"Voice portals" have begun mushrooming around the country. Consumers call a toll-free number and follow a series of voice prompts to get information such as local weather reports, directions to restaurants and stock quotes.

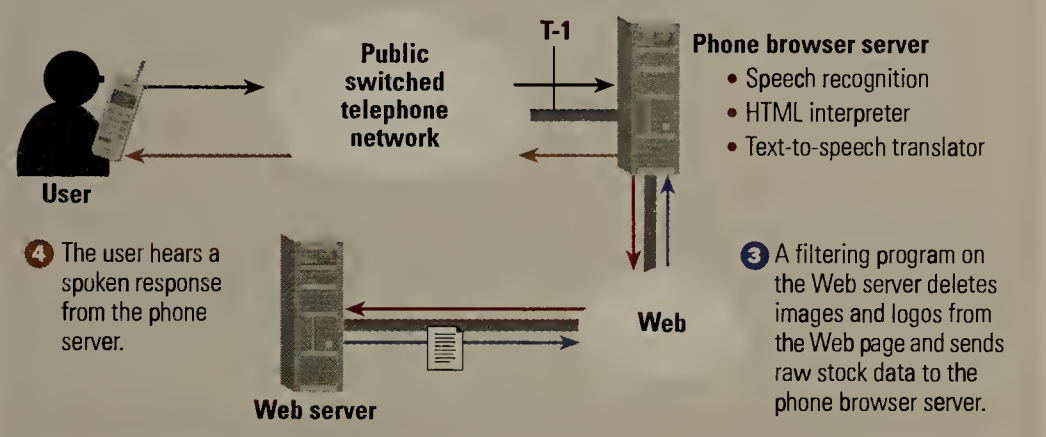
BellSouth and a Reston, Va., start-up called AudioPoint separately offer free, consumer-oriented voice portals based on SpeechWorks software. Neither is truly Web-based at this point — users access a selected batch of news and information feeds at the voice site.

But as the emerging Voice Markup Language becomes an accepted standard and is more widely used by developers, sites such as AudioPoint will open up to a

See **Voice**, page 40

Lucent's phone browser

The company's new technology lets telephone users access data on the Web and in corporate databases.



Novell, Microsoft sharpening metadirectory tools

BY JOHN FONTANA

IT executives perplexed by the recent flurry of metadirectory news are about to get some solid directions from both Microsoft and Novell.

Microsoft is refining its metadirectory services to more closely link it to Active Directory, incorporate support for XML and simplify its use.

Novell this summer will release its DirXML metadirectory, which employs the company's eDirectory as a hub linked to other directories via XML-based connectors. The technology, previewed last month at Novell's BrainShare user conference and currently in beta testing, surprised many with its sophistication, but there are still some questions that have to be answered.

IT administrators should understand that the tools from both vendors will only help them execute their directory integration strategies. They also require considerable hands-on customization.

Microsoft, for its part, is trying to simplify its metadirectory, which it acquired last year when it bought Zoomit.

This summer, the company will release Microsoft MetaDirectory Services (MMS) 2.2, which will focus on closely tying Active Directory into the core metadirectory, called the Metaverse. Microsoft will introduce an Active Directory Management Agent, which manages the connection of Active Directory to the Metaverse. The agent will feature an autodiscovery mechanism that will recognize directory objects and attributes as well as extensions to directory schema — the language that defines the contents of the directory.

Microsoft plans to incorporate an autodiscovery feature into all MMS management agents, including one under development based on XML. The company also intends to introduce up to five agents for enterprise resource planning systems before year-end.

While Microsoft refines its existing product, Novell is polishing DirXML 1.0.

Users and analysts alike were surprised by DirXML's implementation of a key metadirectory function called the "join,"

See **Metadirectory**, page 40

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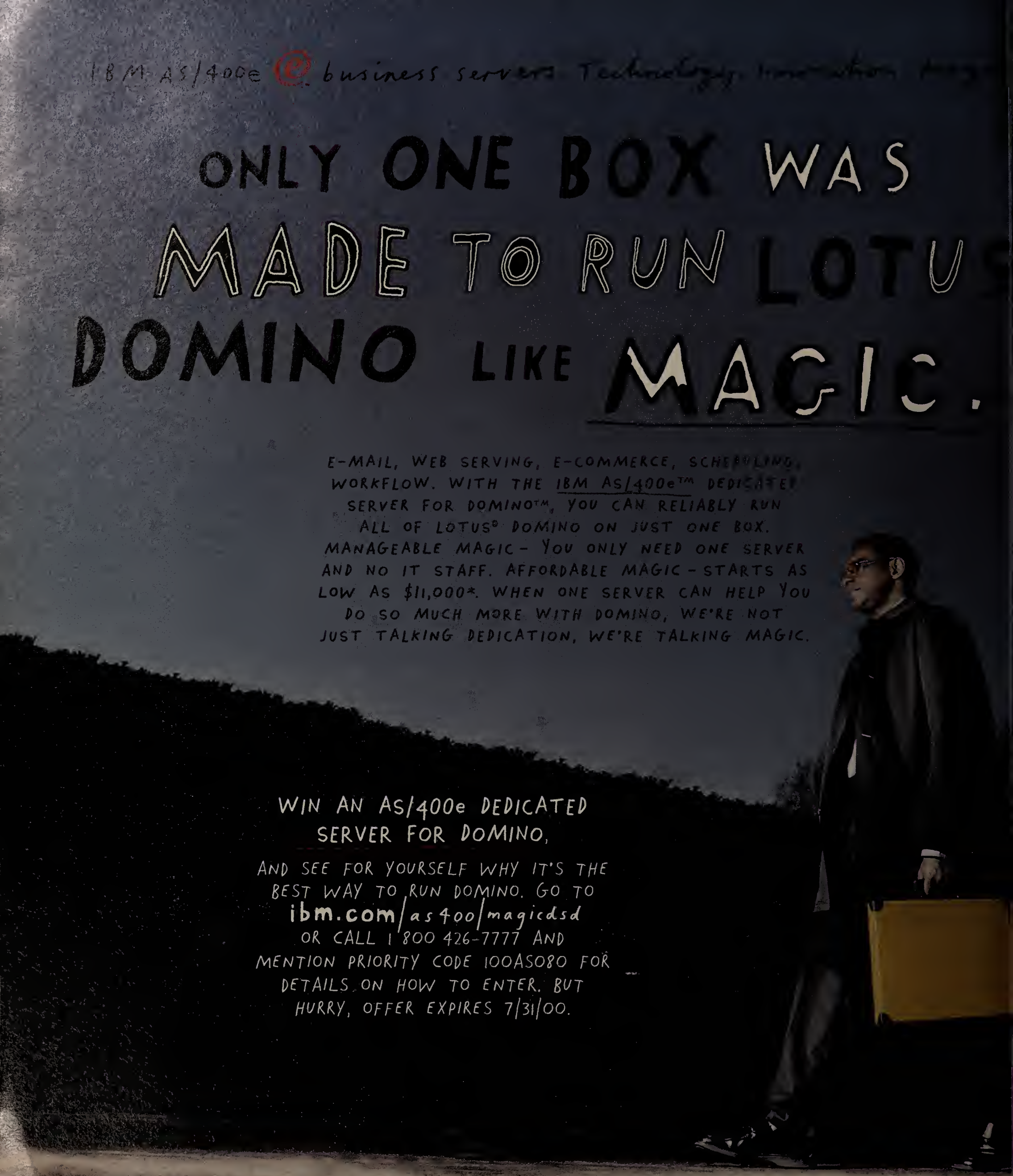

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Employee study cites rampant Internet abuse

BY CAROLYN DUFFY MARSAN

More employees are checking their stock prices, shopping for travel bargains and exchanging personal e-mail via the Internet while at work — even though their companies prohibit these activities, according to a study released last week.

Commissioned by Elron Software, a Burlington, Mass., provider of Internet access and e-mail content filtering software, the study found a significant increase in the number of companies with Web and e-mail usage policies. But the study also found that despite these policies, employees' personal use of corporate network resources is rising.

Elron's second annual corporate Internet usage study was conducted by NFO Interactive, a market research firm in Northwood, Ohio, that interviewed 576 employees who have Web and e-mail access at work. Some 68% of the companies represented in the study have Web usage policies, up from 48.9% a year ago. Approximately 60% have corporate e-mail policies, an increase from 46.5% a year ago.

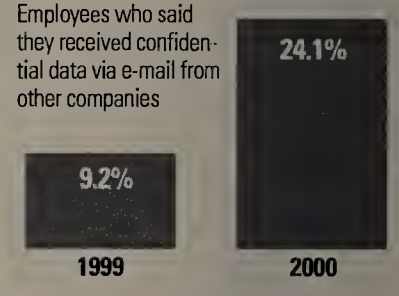
One of the study's most alarming findings is a 170% increase in the number of employees who acknowledged receiving confidential information from employees at other companies. The number of respondents who reported receiving confidential e-mail leaks jumped from 9.2% last year to 24.1% this year.

According to the study, employees are getting more personal e-mails with attachments, with 73.5% of respondents saying they receive these types of e-mails compared with 63.6% last year. Also, nearly one out of five respondents received at least one potentially offensive e-mail per month from a co-worker.

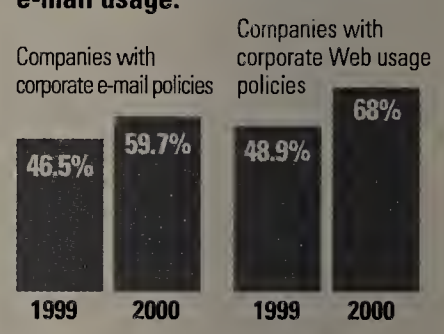
In the area of inappropriate surfing, one in three workers said they spend 25 minutes or more each day using the Internet for personal reasons. Much of that time is spent shopping, with the most popular destination sites being for vacations and vehicles. ◪

Battening down the hatches

In a survey done last month, users said they witnessed a jump in security leaks in the past year, . . .



. . . which prompted more companies to set policies for Web and e-mail usage.



Based on a survey of 576 employees with Web and e-mail access.

SOURCE: ELRON SOFTWARE, BURLINGTON, MASS.

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Making Networks Smarter

Voice,
continued from page 35

broader array of Web-based information services, according to Nick Unger, CEO of AudioPoint.

Early this month, AudioPoint created a Web site (www.myaudiopoint.com) that lets users configure their voice portal account. When a user calls 1-888-38AUDIO, the voice portal will tailor stock reports, sports scores and other information to the user's profile.

These kinds of voice systems typically need complex middleware, such as message queuing or transaction monitoring software, to work with back-end legacy databases.

That's one reason for the appeal of the "voice Web" — you're accessing information that's kept in HTML documents on a Web site. The Lucent phone browser does this by using two additional pieces of software (see graphic, page 35) — one to filter out visual elements, the second to deconstruct the Web page so it can be converted to speech. SpeechWorks has a voice browser in development.

"Right now, the so-called voice browser complements the use of a PC-based Internet browser — it's not replacing the graphical browser," says Elizabeth Herrell, a senior industry analyst with Giga Information Group, a Cambridge, Mass., research firm.

Voice browsers offer limited menu choices, and they can't access all the links on a Web page, Herrell notes.

"But the convenience of being able to access some kinds of information quickly will make a strong market for this software," she predicts.

AudioPoint: www.audiopoint.com; Lucent: www.lucent.com; SpeechWorks: www.speechworks.com

Metadirectory,
continued from page 35

which combines user objects from multiple directories into a logical whole. The Association feature of DirXML creates a join between a user's identity in eDirectory and in other directories. For example, Joe Smith in the eDirectory is associated with JSmith in the human resources directory. This join is a key aspect of creating a metadirectory because user data can be integrated without having to reformat it.

"The join is key, but users still have to write the rules for such functions as what attributes get moved and updated," says Jamie Lewis, president of The Burton Group, a consulting firm in Midvale, Utah. MMS users face the same requirements.

But in DirXML, those rules will have to address the underlying assumption that connections between directories are persistent.

"DirXML will have to have some logic as to the state of the connection," Lewis says. Without that logic, updates made to directories connected to the metadirectory could be dropped if the connection between the directories is down. The eDirectory itself has a queuing mechanism to wait out downed connections. For the connected directories, Novell officials say users can code logic into "shims" that fit between applications and the DirXML connectors, but that will add complexity to deployments.

Microsoft: www.microsoft.com/windows2000/guide/server/features/mms.asp; Novell: www.novell.com/products/nds/dirxml/

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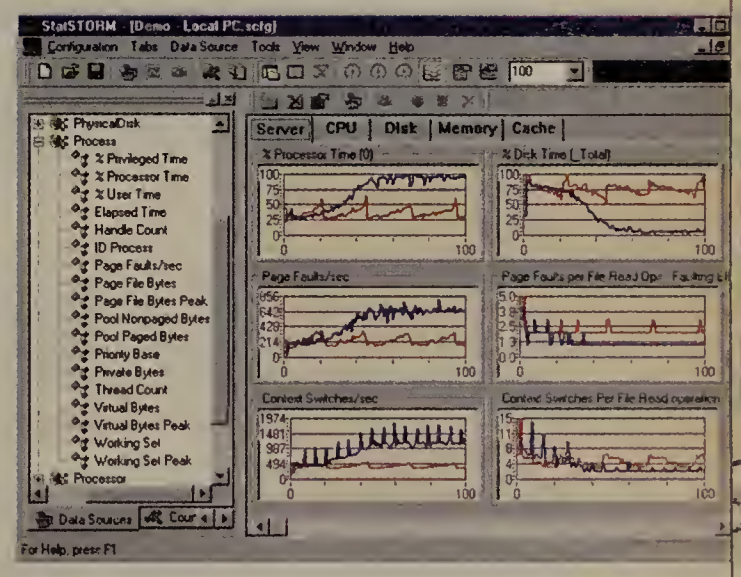

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'Net Insider . Scott Bradner

TODAY'S COUNTRY MUSIC

I'm sitting at home on a Saturday morning writing this column while listening to the "Hillbilly at Harvard" show on WHRB, Harvard's student-run radio station. The show is on every Saturday from 9 a.m. until 1 p.m. and is one of the best radio shows of its type anywhere. But after 1 p.m., it is really hard to find reasonable country music in the Boston area. The local station that claims to be a country music station seems to pride itself on not playing any song older than its listeners and, based on the banter of the announcers, assumes the average listener is about 7 years old. This is a real letdown after the announcers on WHRB.

A few months ago, I found a way to bridge the gaps between Saturday mornings by using this Internet thing that everyone is talking about.

Cousin Lynn, one of the hosts of "Hillbilly at Harvard," mentioned that the station was now online (www.whrb.org). This is not all that interesting to me because I can get the station just fine the old-fashioned way.

But he went on to say that KHYI (www.khyi.com) from Plano, Texas, was broadcasting live over the Internet and that it had very good country music. He was right, and I'm now a regular listener at home via cable modem and at work.

I was aware of the growing number of Internet radio sites, but I had not realized the number or the quality of stations. KHYI transmits at 16K bit/sec. It's not the same as listening over a high-quality FM radio, but it is a lot better than my car radio.

I use RealNetworks' RealPlayer (and worry a bit that Real Networks might be recording my preferences while I'm listening), although KHYI also transmits in Windows Media Player format.

The station is quite good music-wise, even if the announcers vary from smart and articulate to pathetic, but they don't quite understand that they are transmitting to the world. The ads are still for local events, eateries or stores. There is plenty of opportunity for additional advertising revenue here.

It is also impressively inefficient to have the server in Texas send data streams to each individual who wants to listen. I'm sure that intermediaries such as Akamai can help the efficiency and quality, although I rarely get congestion-related problems. But the ideal would be to actually get IP Multicast running as a normal service from ISPs.

At this time, few ISPs are even trying to use multicast because of a mix of technical and business issues. The Internet Engineering Task Force is looking at what can be done to improve the technology, but the business issues will be harder to solve.

Disclaimer: Even though Harvard's business plan does occasionally look like simultaneous multiparty multicast, the above observation is my own.

Bradner is a consultant with Harvard University's University Information Systems. He can be reached at sob@sobco.com.

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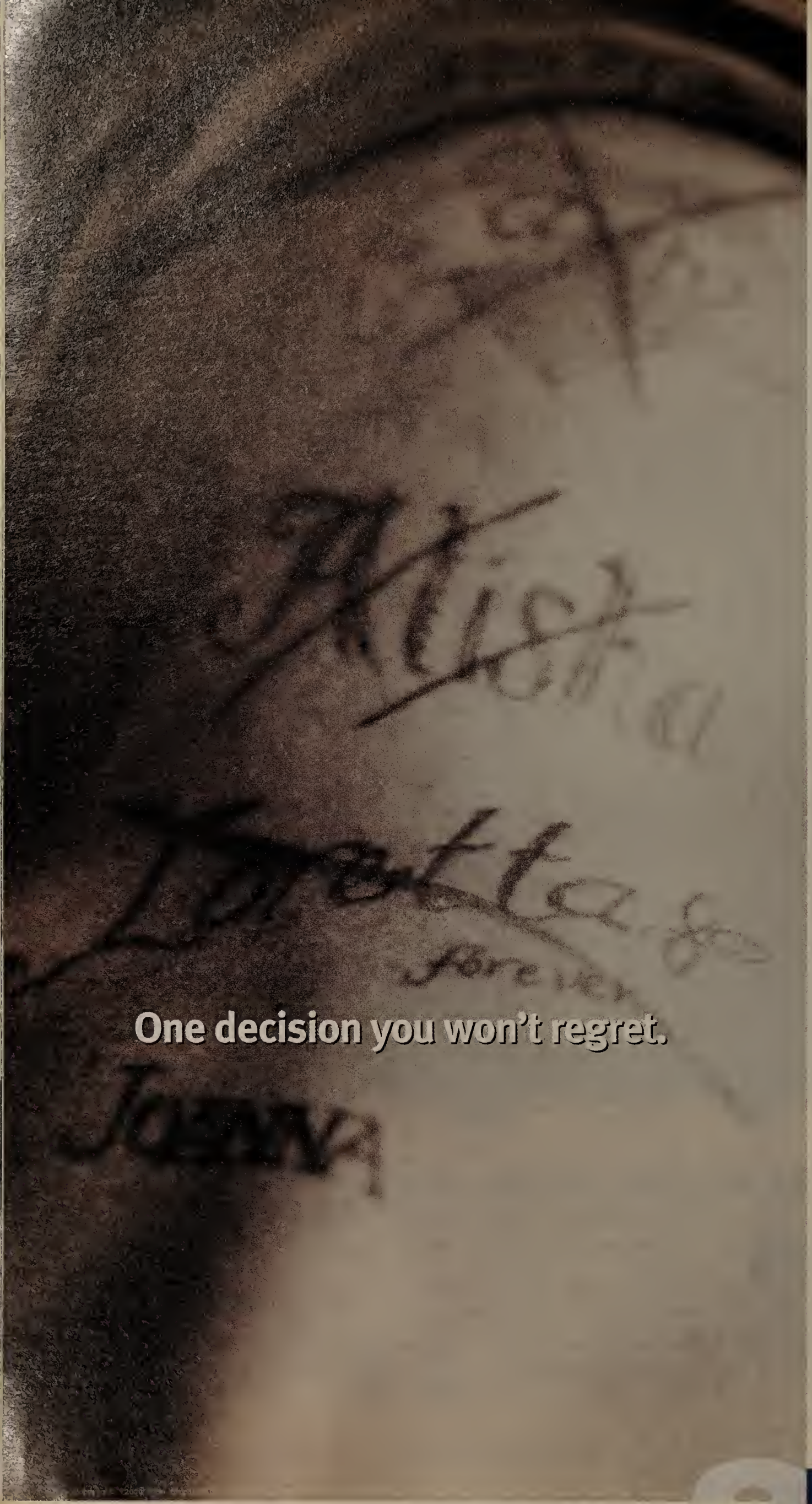

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Technology Update

An Inside Look at the Technologies and Standards Shaping Your Network

Ask Dr. Intranet

By Steve Blass

We use Windows NT Web servers for our intranet, extranet and Web site. We read about a Microsoft Web server in *The Wall Street Journal* on April 14. What is the problem, and how do we protect our Web servers?

The *Journal* reported that Microsoft was investigating a claim by two computer experts who said they discovered a password hidden in the Dvwsrr.dll file, which is part of the Front Page 98 Extensions. The file contains the string "!seineew era sreenigne epacsteN" (read it backwards), but it isn't a backdoor password: It is an obfuscation key used to scramble Web server requests. A Microsoft Security Bulletin, available at www.microsoft.com/technet/security/bulletin/ms00-025.asp, describes a buffer-overrun vulnerability in this Visual Interdev 1.0 component installed as part of the Front Page 98 Server Extensions. It is used by Web authors to generate and view Web site maps.

To eliminate the vulnerability, remove the Dvwssr.dll file located by default in the folder '_vti_bin_vti_aut'. Web servers affected are those built with NT 4.0 Option Pack, Personal Web Server 4.0 or the Front Page 98 Server Extensions. Windows 2000 Web servers, Front Page 2000 Server Extensions, Office 2000 Server Extension and Unix versions of the Front Page Server Extensions do not have this vulnerability.

Blass is a network architect at Sprint Paranet in Houston. He can be contacted at dr.intranet@paranet.com.

Persistence methods key for e-comm

BY CHANDRA KOPPARAPU

Most e-commerce sites and many enterprise applications encounter a major challenge when they deploy multiple servers for scalability. A transaction typically consists of several TCP connections between the client browser and the servers. Once multiple servers are deployed, connections for a given transaction can go to any of the servers.

While many load balancers solve the problem of balancing load across multiple servers, not every one supports the different persistence needs. Because persistence by definition requires load balancers to ignore load conditions on user. This is known as the megaproxy problem. It can be addressed by using cookie-based or virtual source persistence.

Virtual source, which allows the load balancer to treat all traffic from multiple source IP addresses as if it's coming from one source, can be a handy feature for situations in which cookie switching cannot be used and for users who have turned off the cookies in their browser.

There are two ways to do cookie-based persistence.

In the first approach, the Web server sets a cookie value that indicates to the load-balancing switch which Web server a connection must be directed to.

Alternatively, the load balancer can session ID will be directed to the same Web server.

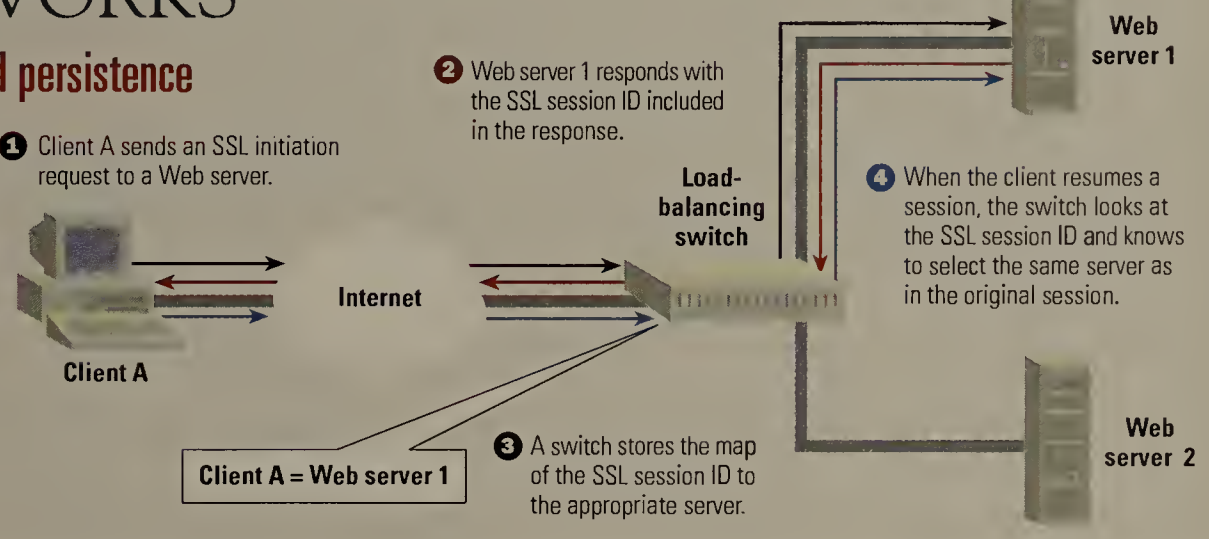
When evaluating load-balancing switches for superior session persistence, it's important to consider their concurrent session capacity. Because ensuring session persistence over extended periods of time can consume a significant portion of the session table, a load-balancing switch must have enough session capacity to handle not only all of the active sessions, but also be able to keep track of persistence information for past sessions.

For example, a load-balancing switch must keep track of 20,000 SSL session IDs to successfully process a shopping cart application for 20,000 customers simultaneously. Load-balancing switches

HOW IT WORKS

SSL session ID-based persistence

Three types of session persistence are of particular importance to e-commerce Web sites: virtual source, cookie and Secure Sockets Layer (SSL) session ID-based persistence. The latter is illustrated here.



servers and select a server based on persistence rules, the trick for load-balancing products is to ensure that the required level of persistence is met while retaining load balancing as much as possible.

For this reason, there are a variety of persistence methods. Three of their methods are of particular importance in building Web sites for e-commerce: virtual source, cookie and Secure Sockets Layer (SSL) session ID-based persistence.

When an enterprise or ISP uses load balancing across multiple proxy servers to connect to the Internet, the same user may be coming to a Web site from a different proxy server for each TCP connection. Therefore, the source IP address in the connection is not a reliable indicator of a given hash on the entire cookie string to select a Web server. Once the load balancer selects a Web server for a given hashing value, it will stick with that Web server for all subsequent requests with the same cookie string. Cookie-based persistence can be used in conjunction with source IP-based persistence to deal with users or situations in which a cookie is not present.

SSL is a protocol used to provide secure e-commerce over the Internet. As illustrated in the graphic, in order to establish an SSL session, the client and the Web server first exchange certain parameters for encryption and decryption. The Web server sends an SSL identifier as part of the negotiation. The load balancer stores the SSL session ID and its association with a Web server to ensure that all subsequent traffic with that SSL that track sessions in central shared memory tend to provide superior concurrent session capacity and support many different network topologies to suit various price/performance and reliability needs.

On the other hand, load-balancing switches that track sessions in memory associated with each port provide very limited concurrent-session capacity due to per-port limitations and impose severe restrictions in the network design.

Kopparapu is a product marketing manager at Foundry Networks, a maker of Internet routers, Layer 3 switches and traffic management products located in San Jose. She can be reached at Chandra@foundrynet.com.

Gearhead — inside the network machine . Mark Gibbs

THE BE-ALL AND END-ALL

In the past three weeks, we explored BeOS, an operating system that Gearhead would describe as better than most of the other stuff you use. We examined the operating system from its feature set (though hardly doing it justice), and this week we'll wrap up with a look at the software and services that come with or can be acquired for BeOS.

Before we do, Gearhead would like to note an interesting, insightful and thoroughly inflammatory comment a reader made about another hot operating system: "I don't consider Linux better — just different and cheap." (That was one of those things you just have to share.)

He also observed: "The more I hear about BeOS, the more it sounds like the programmers from Commodore/Amiga are trying to bring AmigaDOS into the real world. A pre-emptive multitasking operating system designed for multimedia? Where are the Agnes, Gary and Denise chips?" (Those are the Amiga chips used to enhance performance). While pithy, Gearhead would suggest these comments misrepresent the issues. Be that as it may . . .

So you fire up BeOS and what do you get? For starters, network services that, as we said last week, are awesome. If you make a change to your IP configuration, tell BeOS to restart networking, and voila! This on-the-fly, rebootless operation is fundamental to BeOS and Gearhead cannot figure out why Windows can't do this. How hard can it be?

Anyway, along with networking you get a Web browser called NetPositive, which is simple and quite fast. If you're looking for more oomph you can install the Opera browser (http://www.opera.com/beos/), which is very good under Windows and even better under BeOS. Opera features an e-mail client, 128-bit encryption, TLS, SSL 2 and SSL 3, CSS1 and CSS2, XML, HTML 4.0, HTTP 1.1, WML, ECMAScript and JavaScript 1.3, as well as a small footprint.

NetPeguin is Be Corp.'s FTP client, and while there's no Web server on the Version 4.5 CD or in Version 5, there are several third-party products available (see http://www.be.com/software/).

The fun stuff that comes with BeOS includes a flying-through-the-stars application, like the Windows screen saver but much more interesting. If you are really interested in the stars grab a copy of 3D Starchart (http://users.deltanet.com/users/axly/starchart/), which lets you view the universe in three dimensions from any point in space (that is, you're not tied to the solar system).

This application shows off BeOS's multithreading and smooth graphics. Another cool graphics feature is the bundled sound editor, 3dmix, which is similar in concept to Gearhead's favorite music toy, Sonic Foundry's Acid. 3dmix has some amazing graphic displays that are synchronized with the music, and you can use it with the output from Drum Circle, a drum sequencer also bundled with BeOS.

As for programming, there's C, Python, Perl and Rebol, along with debuggers and integrated development environment systems. The one missing language is Java, which Be was due to deliver early this year, but it is still in development (check out coffeeBEan at http://www.cyberclip.com/Be/coffeeBEan.html as an alternative).

Gearhead could happily go on exploring BeOS, but, alas, we must move on.

Next week, something different from gh@gibbs.com.

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pcAnywhere	**5-10**	**B**	**B**	**B**	**B**	**B**	**B**
LapLink	**20**	**C**	**C+**	**B**	**A**	**B**	**B**

Reported by *Computer Reseller News*, May 24, 1999.

NetOp Remote Control is the award-winning solution taking enterprise management and support desk software opportunities to new heights. According to *Computer Reseller News*, "There is a lot to like about the CrossTec channel program. Margin is rich but more to the point, so is its program, with extensive sales and marketing assistance and free time-limited software to give clients a taste for the package."

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Editorial

Stock gyrations and what we can expect next

The stock market is an odd creature with largely unpredictable habits, but when you stop and look backward those habits seem to fall into recognizable patterns. That gives rise to predictions about what the market will do in the future.

And so the cycle continues, despite ample evidence that the stock market is an odd creature with largely unpredictable habits.

Here we are at the end of a particularly wild cycle and I, like millions of other would-be stock analysts, can't resist analyzing the recent past in an effort to see the future.

The market, it seems, had been run up on the backs of "technology" companies, everyone from network infrastructure players to would-be "e-tailers" trying to make a go of selling items over the Web.

Wall Street and the public rewarded these companies handsomely because we are, after all, in the middle of a technology revolution. That largess gave rise to more companies looking to cash in on the gold rush, even companies with questionable business plans.

When it became clear with time that some of these new emperors weren't wearing any clothes, people looked around and saw how badly inflated things had become and started an all-out retreat, hence the huge stock sell-off.

But had anything really changed? Not really. Perhaps there were some dogs that needed to be shaken out, but it wasn't long before the market woke up to the fact that technology was still central to American business.

In fact, I would argue we are only about a third of the way into this profound shift. The real story is still unfolding. Companies like GM and Ford are just now embarking on business-to-business electronic exchanges that will profoundly change the way they buy parts. Major retailers like Wal-Mart and Sears have yet to realize the full potential of the Web. And upstarts like Amazon.com and Yahoo still have open vistas before them.

There isn't a company in the country that's not looking at how to reorder its business around this new medium, and that much change means huge opportunity and huge investment.

There will, of course, be bumps along the way. But I suspect we'll see a healthy technology stock sector for a few years to come.

— John Dix
Editor in chief
jdix@nww.com

Message Queue

FATHERS AT WORK

I can relate to the issues raised in your article on fathers balancing work and family ("Shift change," March 27, page 60). I work for a dot-com company in Denver, and from my start date last September until just a month ago, I was consistently working 65 to 85 hours per week, and many times I worked all night.

I'd be so tired when I got home that I wouldn't have the energy to spend time with my kids, the youngest of whom is still in his first year. It's only been in the last couple of months that he's seen me enough to know I'm Daddy.

Of course, with the existing labor shortage, which makes it difficult to add staff easily and thus decrease workload, this issue will probably continue into the foreseeable future.

Chris Mallow
Westminster, Colo.

Never feel guilty about putting family first. There are lots of companies. You've only got one family. You can never get back the time you missed with them. Anyone who has a spouse and children and spends 12 hours a day at work has grossly misplaced priorities.

Ron Fox
Willow Springs, Ill.

After 11 years of marriage and two children, my wife decided that she had had enough of being on the back burner in my life. What always came first? Work. If it wasn't someone's PC that was down and just had to be ready the next morning, it was the fact that even if I was home, I wasn't really "home," because I was working on something else.

I truly believed and justified my actions in the best interests of my family. "It's my job, it's what I have to do" is what I would say. But as someone once told me, you work to live, not live to work. If your job interferes with your life to the point that it becomes your life, then what's the use?

I closed my service business and am working for a manufacturing firm that has more than one person to rely on — not just me. I am happier now, although I cannot undo the damage that has been caused over the past many years. Perhaps someone else will see this letter and mend their ways, quick.

The work will always be there, and you're not the only one that can do it. But when it comes to your family, you are the one that needs to be there.

Aaron Cutshall
Systems analyst
ELSA Corp.
Muncie, Ind.

I'm a mom and an IT professional. If corporate America had listened when working moms first started having these problems, these issues would have been licked already. What we need is more enlightened management. If the managers are neanderthal about family issues, the environment will be unfriendly. Workplaces that were traditionally female-oriented, such as insurance, medical and education, have been dealing with this issue effectively and humanely for years, and now it's the technology sector's turn.

It is my sincere hope that men and women with the right attitude toward giving all workers a decent place to work, along with the ability to have a life, will make their way into management or influence management to provide a breath of fresh air.

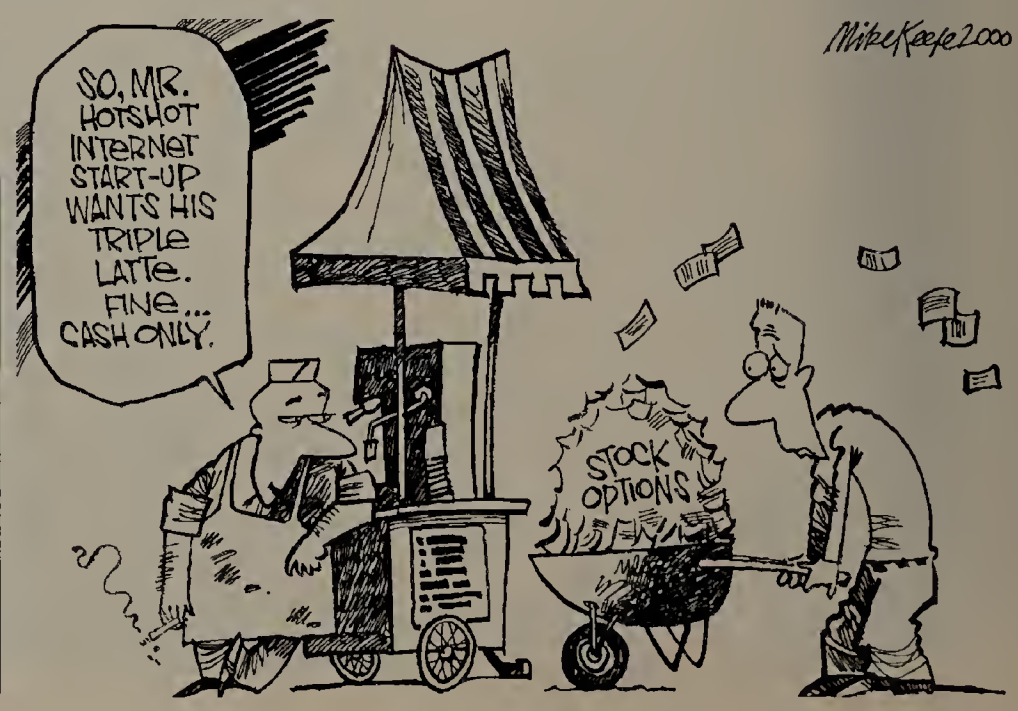
M.L. Starkey
Dracut, Mass.

BAD IS BAD

Just who does Internet Security Systems CEO Thomas Noonan think he is? ("ISS fires 'bullet' at viruses," April 3, page 100). If ISS' Bullet application removes or modifies a connected computer, that is exactly the same as a cracker getting in and changing files. I thought that this was a violation of federal law.

Robert Chase
Professor of Mathematical Sciences
Sweet Briar College
Sweet Briar, Va.

Send letters to nwnews@nww.com or John Dix, editor in chief, Network World, *118 Turnpike Road, Southborough, MA 01772. Please include phone number and address for verification.*



The Networked World Webcast . John Gallant

Network World hits the big screen, babe

"Hey, babe, I've got a couple of primo screenplays in development, so why don't you have your people call my people and we'll do a deal over lunch at Spago's."

OK, I've got the networking lingo down — you know, TCP/IP, caching, the "Internet space" and all that — but I've got to work on my Hollywood-speak now that *Network World* is moving to the silver screen.

Actually, we're moving to your computer monitor with the May 5 launch of our monthly Webcast called "The Networked World." If you just can't get your fill of *Network World* in print each week or on the Web each day, now you'll have the chance to see us live every month as we bring to life the issues and technologies shaping the networked world through the magic of Internet broadcasting.

With the help of our sister company ITWorld.com, we'll be Webcasting "The Networked World" to anyone who signs up to hear our debates, listen to our columnists opine and join in the discussion via e-mail or phone. The show will run about 30 to 40 minutes, and you can tune in as it happens or watch the recorded event at your convenience.

What will you get if you commit a half-hour of your workday to our program?

First, we'll have a "Virtual Showdown" — hosted by me, babe — on one of the hot issues of the day. Using a "McLaughlin Group"-style format, the two opposing pundits will go head-to-head in a skip-the-PowerPoint-and-get-to-the-point debate. Our first topic: application service providers (ASP) — one of the most overhyped concepts of the day. My question to our debaters: Are ASPs fully baked? Or does this idea still have a lot of cooking ahead?

For upcoming shows, we'll explore what the feds ought to do to Microsoft in the penalty phase of the antitrust suit, whether digital subscriber line or cable will win in the broadband access struggle, whether the government needs to impose stricter privacy rules, and other contentious subjects. The beauty part — as my son would say — is that you get to join in and challenge our speakers. You simply type in a question or call our toll-free number (just like those radio talk shows).

In addition, we'll have a segment exploring the hottest news in networking with "NetFlash" author Doug Barney, and you'll hear "'Net Buzz" columnist Paul McNamara as he looks at the best and worst developments in the Internet economy. "Backspin" and "Gearhead" author Mark Gibbs will wrap up each show with his own unique take on the world of networking and anything else that pops into his mind.

To register for the Webcasts, go to www.itworld.com/itwebcast/nw. After you sign up, drop me a note about what you want us to debate on the show and then mark the time (1 p.m. EDT, Friday, May 5) on your calendar.

We want you to be a big part of this Hollywood gig, so plan to do lunch with us, babe.

Gallant is editorial director of Network World. *He can be reached at jgallant@nww.com.*

Reality check . Thomas Nolle

CLECs' real role: Providing advanced services

Regulatory trends seem to be going against the competitive local exchange carriers (CLEC) these days. Many say the CLECs depend on access to incumbent LEC (ILEC) infrastructure for their survival. If this is true, can CLECs continue to play a role in telecommunications, or will the future be a battle among the facility owners such as the regional Bell operating companies and cable companies? Is local exchange competition going to be competition among the few?

The answer is yes, unless the CLECs get smart.

The Federal Communications Commission, in a November 1999 rule-making and in its actions regarding the SBC Communications/Ameritech merger, has given ILECs approval to deploy modern packet-mode digital infrastructure to provide universal high-speed service capabilities to businesses and consumers.

In return, the FCC has promised the ILECs that most of the new infrastructure will be shielded from unbundling. This limits the CLECs' ability to exploit the incumbent network and, in some cases, may enslave the CLECs' service plans to the specific product strategies of certain ILEC vendors, such as SBC's fiber remote favorite, Alcatel.

But the real debate isn't so much whether a CLEC should be able to install a card in an ILEC's fiber-remote equipment shelf as it is whether CLEC competition is the way to provide universal advanced services. The telecom act assigns the FCC the responsibility to promote this noble service goal, and the FCC seems to have adopted the view that facility owners such as the ILECs are really the only way to bring about universal digital services.

To understand the CLECs' problems and future, you have to consider a misunderstanding about the telecommunications act. It wasn't really about creating competition; it was about creating a modern digital-access infrastructure. Competition was one of the ways to achieve that goal.

The act let the ILECs into the national advanced services market, where virtually all future data opportunity is found, as an incentive to modernize their networks to better support advanced services. If the ILECs let modernization languish, the CLECs would step in and fill the gap.

Given this approach, it's not surprising the current FCC policy links the shielding of ILEC network elements to the deployment of advanced-services-capable broadband networks. But what now for the CLECs?

Well, CLECs can still exploit home-run copper or fiber as before because customer loops must be made available as unbundled elements no matter what kind of ILEC infrastructure is in use. In the near term, this gives CLECs access to perhaps one-third of the target customers — those with high-service revenue potential. In time, ILEC's provisioning practices may erode the current base of home-run fiber and copper in favor of fiber remotes and short loops, but CLECs have a few good years left in their traditional space.

If they want it, that is. Industry statistics suggest the profit margins on access services alone are less than 15%, far too thin to support an aggressive sales/marketing program for a CLEC, and too small to provide an attractive return for a CLEC's investors. On the other hand, the new ILEC infrastructure would let the CLEC wholesale digital access from the ILEC, freeing up its capital to create new competitive services with higher profit margins.

Putting this another way, how could any CLEC strategy to serve customers with digital-access connections — being necessarily limited in terms of scale — hope to be competitive with the architecture of a large incumbent that already touches tens of millions of customers?

The CLECs need to stop hitting the ILECs where they're strong and instead target their weak spots. Let the ILEC provision the customer and compete instead with the ILEC's advanced-services subsidiary in providing the services across that infrastructure.

All this techno-debating as to whether CLECs or ILECs get to own digital subscriber line (DSL) cards ignores the fact that the real future of networking isn't created by pushing bits, but by pushing services. Sure, the ILECs can and will shield more of their networks from unbundling at the cost of being able to offer lucrative data services directly to the users. Their future now depends on how successful their advanced-services subsidiaries will be in providing customers the services they want.

If the CLECs are willing to stop trying to salvage a DSL strategy that could never have hoped to be competitive to begin with, they can still build a service business that will threaten these subsidiaries' ability to compete and grow.

Nolle is president of CIMI, a technology assessment firm in Voorhees, N.J. He can be reached at (856)753-0004 or tnolle@cimicorp.com.

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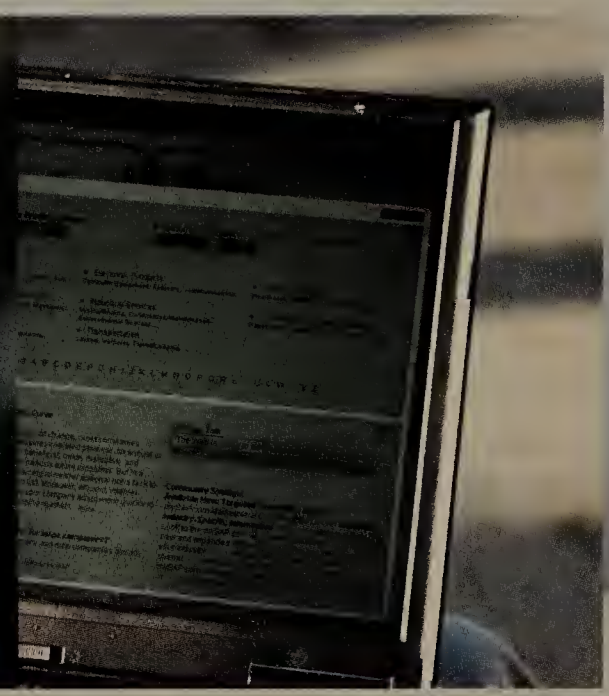

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Habits of healthy help desks

TOM NORTON

IT experts divulge five tips for maintaining order within the network and keeping end users happy.

BY BONNY GEORGIA

Want to keep your network humming like a well-oiled machine? It takes more than a team of smooth-talking techies and a service hot line to handle the job. Network World *asked three experts to share their favorite help desk strategies.*

Hire service-minded help.

When staffing a help desk, the knee-jerk approach is to look for highly experienced technical minds. But solid customer-service skills are not as easily trained as technical know-how. That's why Lawren Findley, user support coordinator for Haynes and Boone, an 800-employee law firm in Dallas, wants people with a service-minded attitude.

"I don't demand certifications or college degrees. I look for people who really want to do user support. A couple of my best people actually have a legal background. These people care about our users and want the firm to be successful, so they work hard," Findley says. Recognizing the need for new employees to be a good match with existing staff, Findley gives her department a say in the hiring process.

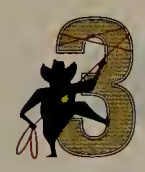
Don't bore support staff to death.

Assigning your staff to specific service levels and routing all network problems to the NT wizard or groupware issues to the Lotus Domino expert might increase call center efficiency. It's also the fast track to boredom and burnout.

Variety ensures a happier help desk, notes Findley, who requires anyone available to answer incoming questions; no calls are routed to specific staffers. "They're constantly challenged to learn because they never know what kind of question will come next," she says. Her policy of rotating staffers off the desk and onto floor support two days per week is also popular, both with help desk staff and the firm's employees. "We strive to visit every office at least once per day. Users get to know us and really feel like we're there to help them," she says.

Another way to ward off turnover is to offer ample training and career growth opportunities, says Marianne Bays, measurement services director for Technology & Business Integrators in Woodcliff Lake, N.J.

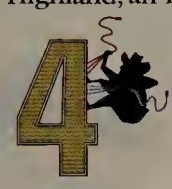
"Pay for continuing education. Reward your employees for earning certifications," Bays recommends. "Expect them to grow and offer them a distinct career path."



Use multiple service options to maximize efficiency.

To increase the flexibility and effectiveness of your help desk, consider augmenting telephone and in-person support with self-help knowledge bases, automated e-mail or live chat tools. "All users are not the same," Bays says. "Some might want you to e-mail them a resolution; others may prefer you to call them back. In remote situations, you need to be able to escalate calls on the fly or have higher-level representatives answering the calls."

Keep in mind that these alternatives require tight integration with your existing trouble-ticket system or reliable response tools of their own. "Many companies jump on the e-mail and Web support bandwagon and get buried without the proper response mechanisms in place," says Deborah Phillips, principal of North Highland, an IT consulting firm in Atlanta.

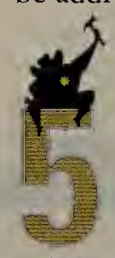


Balance the daily grind against long-range goals.

The best help desks recognize the importance of balancing short-term tactical activities against long-term strategic efforts, Phillips says. "Tactical thinking is reactive and transaction-based. You're being tactical when you're concerned with how many phone calls or e-mails you can take or the procedures for managing calls," she says.

Although operating in a firefighting mode resolves the issues of the day, "you need to be thinking strategically about eliminating these problems," Phillips says.

Encourage employees to look beyond individual calls for symptoms of larger trouble spots that can be addressed with hardware or software tweaks or user training.



Measure success properly.

Customer service goals are useless without a way to see if you're meeting them. The trick is to reward and measure the right things.

"Measuring the number of calls resolved or tickets closed on the first call encourages the help desk to close things that are unresolved. Make sure you're measuring problem resolution in the eyes of the user," Bays says.

Some good measurements of help desk effectiveness include how long it takes to answer calls, how many calls are abandoned and what percentage of problems have to be reopened within a certain amount of time.

Georgia is a freelance writer based in Hudson, Mass. She can be reached at bonny@wordsatwork.net.

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Know your network vendor

With as many network vendors spinning off, selling off or, as in the recent case of 3Com, killing off their enterprise businesses, you need a scorecard to keep track of who offers what, who owns who and who's still around. That's what this Signature Series edition, the Network World 200 Issue, is all about.

In these pages, you'll find our annual ranking and analysis of the top 200 U.S.-based public network companies. You'll find an update on what enterprise network markets will flourish this year and what hot start-ups made it onto our yearly "10 companies to watch" list. And, in special features, you'll learn about the new R&D, how to unearth secrets buried in annual reports and what's the latest in customer service. Of course, the info fest continues online, with an interactive NW200 chart, the new NW200 stock index and more.

Through it all, we give the information you'll need to make smart decisions about the network vendors with whom you chose to do — or not to do — business. Digest it well, and perhaps you'll be able to stave off the hassles that come when your network vendor dramatically alters course — after all, such changes are rarely sudden.

— Beth Schultz,
Executive Editor,
Signature Series
bschultz@nww.com

The Signature Series

The Network World 200 Issue is one of six bimonthly supplements providing insights, opinions and information on the biggest trends shaping the networked world. Find all about your job, salary, future and free time in our next installment, The You Issue, coming July 17.

The Signature Series

Network World 200

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NetworkWorld 200

Net

THE FORTUNES OF THE NETWORK WORLD 200 — THE IN 1999 AS NETWORKING MOVED FRONT AND CENTER,

By John Dix

If you need any more proof that the world has woken up to the fundamental importance of networking, consider this staggering fact: The stock value of the Network World 200 — the 200 largest U.S.-based public network companies – has passed $5 trillion.

And why not?

Networking is remaking corporate America, pushing the economy along in front of it, and this stock valuation simply reflects the fact that the NW200 companies are the key enablers of this profound shift.

Of course, market capitalization is an ephemeral measure and by the time you read this the bloom might be off the rose. So try this as a telltale of industry health: The NW200 added $100 billion in revenue between 1998 and 1999, soaring 14% from $709.7 billion to $809.6 billion. That compares with 10% growth from 1997 to 1998.

Profits fared even better, jumping a whopping 39%, from $55.3 billion in 1998 to $76.9 billion in 1999, compared with a 1.8% drop from '97 to '98. But not everyone shared in the revelry. Some 75 of the NW200 companies reported losses for the year, only a hair better than the 79 that were running in the red in 1998.

As was the case in '98, the companies reporting the largest losses are in investment mode. Take the ambitious young firms making a go of it in the capital-intensive telecommunications businesses. Competitive local exchange carriers (CLEC) WinStar and Nextlink posted losses of $638 million and $559 million, respectively, as they continued to build out their networks.

With so many of the NW200 reporting losses, the group's collective 39% profit jump in 1999 looks all the more remarkable. The companies that did well last year, did very, very well.

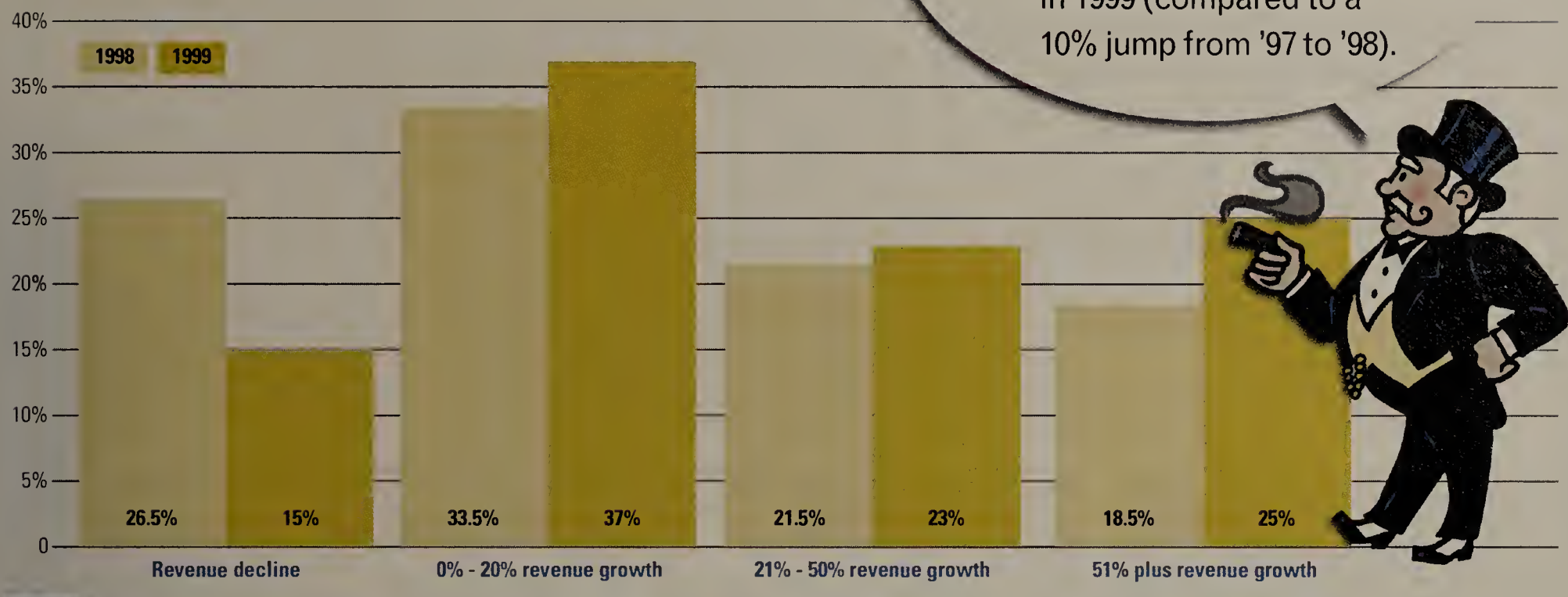
Witness perennial powerhouse Cisco (19 on the list), which last year drove revenue up 43% to $12.2 billion and profits up 55% to $2.1 billion. Five years ago, Cisco was 35 on the NW200 with revenue of only $2.3 billion and profits of $456.5 million.

With this latest growth spurt, Cisco leapfrogged Sun on the list, even while Sun managed to grow its revenue base 20%.

More amazing is the success Cisco has had on Wall Street. Adding $3.7 billion in revenue is no small feat for an $8.5 billion company, but how about adding $315 billion in market value at the same time? When we captured market cap data on March 3 after the NW200 list was completed,

ACROSS-THE-BOARD IMPROVEMENT

Revenue improved for a host of players, but some fared better than others. Here's the percentage of NW200 companies that saw . . .



Revenue

for the NW200 was up **14%** from $709.7 billion in 1998 to $809.6 billion in 1999 (compared to a 10% jump from '97 to '98).

ILLUSTRATIONS BY ISABEL SAMARAS

business

LARGEST U.S.-BASED PUBLIC NETWORK COMPANIES — SURGED FORWARD DRIVING BUSINESS CHANGE, THE STOCK MARKET AND EVEN THE ECONOMY.

Cisco's value was a staggering $470 billion, a far cry from the $155 billion of one year earlier. (As of this writing, the company's cap crossed $555 billion, surpassing Microsoft's value and making Cisco the most valuable company in the world.)

Market cap doesn't mean much to the average Cisco customer, but it is the capital Cisco uses to fund acquisitions. This means Cisco shops can count on the company to continue rounding out its product line. Cisco acquired 18 companies last year and seven in the first three months of 2000.

A number of other multibillion-dollar companies enjoyed double-digit revenue growth last year, including AT&T, Compaq and Microsoft. But one standout was Dell, where revenue rocketed 48% to $18.2 billion and profits climbed 55% to $1.5 billion. Dell vaulted to 16 on the NW200, moving ahead of US West and Sprint for the first time.

ON LINE

IN THE MIX. Use our NW200 Compare o matic to mix and match variables about the companies that interest you. This interactive tool lets you plug in the fields you want and then download the results.

DocFinder: 7821

Said another way, the $6 billion in revenue Dell added last year was greater than the combined revenue of the 68 companies that bring up the rear of the NW200. Often that kind of phenomenal growth is driven by acquisitions, but in Dell's case, it was "principally due to increased units sold," the company reports. Sales of Dell's enterprise systems, including servers, workstations and storage gear, were up 130%. Notebook sales — also a business staple — were up 108%.

Scaling revenue that fast required Dell to grow its workforce 52% last year to 24,000. The NW200 as a whole employed roughly 2.9 million people. That means the NW200 companies, on average, generated about $279,161 in revenue per employee last year. While that's low for Cisco and Dell — which earned $578,762 and $747,664 per employee, respectively — it is right on for companies like IBM, which last year generated $284,801 per employee.

In Wall Street terms, each of the 2.9 million NW200 workers generated about $1.75 billion in market value. Try comparing that to any other industry.

The general health of the networking industry belies the amount of change afoot. Players are changing, the dawn of software rental is upon us and the world of "e" is tipping everything on end.

Industry trends

Perhaps the biggest story of all coming out of 1999 is the shuffling of the enterprise deck.

Cabletron changed bosses last June and broke up in February. IBM bowed out of enterprise network gear last September. And in March, 3Com backed away from many enterprise products.

It all started midyear when Craig Benson, Cabletron chairman, president and CEO, decided to follow fellow co-founder Robert Levine into retirement. His replacement, Piyush Patel, former CEO of

Continued on **page 62**

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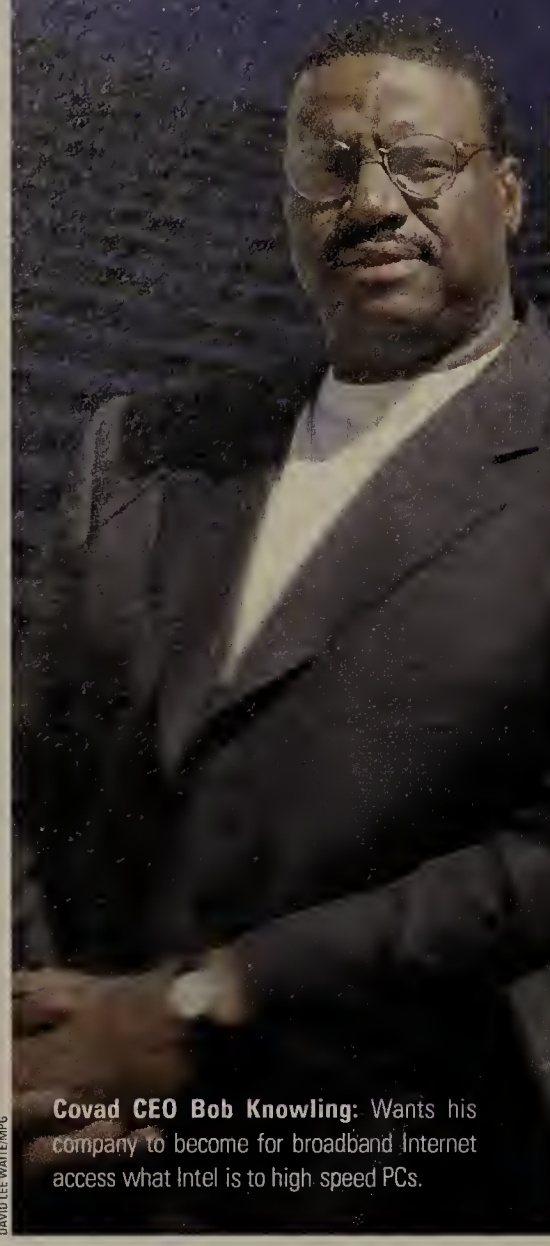
The business of broadband

On fire, high-speed Internet access provider Covad Communications sits atop the list of fastest-growing Network World 200 companies.



Covad CEO Bob Knowling: Wants his company to become for broadband Internet access what Intel is to high speed PCs.

DAVID LEE WAITE/MPG

Bob Knowling, CEO of upstart competitive local exchange carrier Covad Communications, likes to envision his phone company competitors as ugly old giants sleeping lazily on their front porches. And he's running like mad to give Covad some distance in the broadband Internet access race before those slumbering foes awake.

In 1999, Knowling set Covad on course to become a dominant provider of digital subscriber line (DSL) services. Market analysts say he's been relatively successful so far, with Covad having grabbed more than 10% of the DSL market. The Santa Clara carrier has deployed more DSL lines than any other CLEC, but despite Knowling's belief that the Bells aren't taking the market seriously yet, faces stiff competition from incumbent LECs.

Covad's financials tell its story of success. Revenue rocketed 1,148%, from $5 million in 1998 to $66 million in 1999. That staggering growth places Covad atop the Network World 200 list of fastest-growing companies, well ahead of the other big gainers.

To be sure, it helps that Covad provides a hot commodity — high-speed Internet access. "The expanding need for bandwidth has really facilitated revenue growth opportunities," Knowling says.

True enough, agrees Claudia Bacco, vice president of TeleChoice's DSL consulting service. But among CLECs, she adds, Covad has excelled because it's maintained focus — on the type of customers it wants to serve, the flavor and speed of its DSL offerings and making it easy to order online.

Covad has captured its chunk of the DSL market in part by selling DSL services to enterprise users but mostly by wholesaling services to 300 ISPs, which in turn sell DSL to residential and business customers. It hopes to sustain its growth rate by bringing application service providers and "big-brand, brick-and-mortar" companies into the Covad fold, Knowling says. To do the latter, it recently acquired LaserLink.net, which provides branded Internet access to 68 million subscribers, in a stock deal valued at about $387 million. LaserLink allows enterprises to increase brand affinity by providing their customers with Internet access, e-mail accounts — say, bknowling@amway.com — and the like.

Prior to the LaserLink.net acquisition, Knowling was projecting $235 million in revenue for 2000 from 290,000 subscribers. Those estimates are conservative and will be adjusted to account for the additional business Covad expects through LaserLink.net, Knowling says. Based on his original numbers, Knowling says he expects revenue to surpass a $1 billion run-rate by 2003.

"Our current business plan of record will allow us to pass 50% of businesses and 44% of homes with DSL service this year," says Knowling, while pitching the slogan "Covad Inside." Like they associate Intel inside PCs, people will one day think of Covad as providing the high-speed pipes needed for zippy Internet service. "I want to put up the most pervasive network in the world, so people come to know that their Internet experience is facilitated by Covad," he says.

And that, Knowling says, precludes Covad from playing exclusively in the DSL market. In fact, it means Covad will eventually have to move into wireless, cable modem or other high-speed access services.

After all, Knowling concludes, "This is not about DSL. It's about broadband."

— Beth Schultz

Continued from page 59

YAGO Systems, which Cabletron acquired in 1998, had the unenviable task of righting the troubled company.

Seven months later, Patel broke Cabletron into four companies — Riverstone Networks, to focus on service provider gear; Enterasys Networks, to cater to the enterprise; Global Network Technology Services, to provide professional services; and Aprisma Management Technologies, to sell the Spectrum network management platform. Shortly thereafter, he announced plans to divest Cabletron of additional enterprise business lines — the Digital Network Products Group and NetVantage.

It's too early to tell if these moves will help reverse the ailing company's fortunes, although Cabletron was showing promise even before the recent changes. The company's fiscal year starts March 1, so it actually closed the books on this year's NW200 numbers some 14 months ago. For that period — which was largely in 1998 — the company posted revenue of $1.4 billion and a $245 million loss.

When the company closed the books on 2000 this Feb. 29, things were looking better. Revenue increased 3.4% to $1.5 billion, and the company showed a profit of $464 million.

While Cabletron was quietly formulating its divestiture plan, IBM shocked the industry in September when it agreed to sell its switching and routing business to its longtime nemesis. Cisco paid $600 million for IBM's primary network assets and, as part of the plan, agreed to buy $2 billion worth of parts and chips from IBM over the next five years.

The third enterprise shoe dropped last month, when 3Com announced it was backing away from its large enterprise LAN and WAN switches, a result of dismal developments in 1999.

Like Cabletron, 3Com's fiscal year ends early in the year, in late May. So even though the company's fiscal 1999 numbers (which appear in the charts) don't look that bad, they only tell half the story.

3Com closed '99 with revenue up 6% to $5.8 billion and profits of $404 million. But the nine months ended Feb. 25 haven't been kind to the company. Revenue was down 2%, to $4.3 billion, compared with the same period in fiscal 1999. And even though profits were up from $316 million to $821 million, the latter included a $750 million gain from investments.

Analyzing the last quarter alone is telling. For the third quarter of 2000, ended Feb. 25, sales of network interface cards, analog and broadband modems and home networking gear were down 11% from the second quarter and 15% compared with the third quarter the year before. Sales of switches, hubs, LAN telephony products and multiservice platforms were

SUFFERING THE MOST

Largest decline in revenue, 1998-1999.

1999 Rank	Company	1998-1999 % Δ
144	Auspex Systems	-33%
106	Digital Microwave	-31%
74	Adaptec	-31%
75	Network Associates	-31%
200	Asante	-27%
183	Larscom	-27%
139	Dot Hill Systems	-26%
45	National Semiconductor	-23%
180	ODS Networks	-22%
109	Exabyte	-22%
93	PictureTel	-20%
152	Osicom Technologies	-20%
90	Telxon	-16%
126	VTEL	-16%
101	Network Equipment Technologies	-15%

flat compared with the preceding quarter and down 7% from the year-ago quarter.

When 3Com spun off part of its wildly popular Palm division in early March, it wasn't long before the highflying initial public offering had a higher value than 3Com proper. That must have put the rest of the business in dismal perspective. A few weeks later, 3Com announced a major restructuring, the core of which was a retreat from enterprise equipment and a refocusing on small and midsize businesses, service providers and home networking.

Many customers have been left holding the bag, but it was clear 3Com didn't have much choice — yet another victim of Cisco's success. (See "Is your vendor healthy?" page 83.)

Although it's hard to pin 3Com's decline on any one misstep — and leaving aside for the moment the ongoing problems it had digesting U.S. Robotics, which it acquired for $7.3 billion in June 1997 — one glaring miscalculation was how 3Com approached the Gigabit Ethernet market.

A cadre of start-ups beat all the big players to the gigabit punch, so most of the network veterans responded with acquisitions early on. Cisco bought Granite Systems, for example, and Bay Networks bought Rapid City. 3Com responded instead by reselling Extreme Networks' low-end box while it worked on its own switch. When 3Com finally got the CoreBuilder 9000 out the door, it took another 18 months to deliver Layer 3 Gigabit Ethernet blades for the box.

3Com couldn't have picked a worse market to bobble. Cisco's Catalyst 6500 Gigabit Ethernet switch reached $1 billion in revenue faster than any other product Cisco has ever brought to market, says James Richardson, senior vice president of Cisco's Enterprise Line of Business.

Even the gigabit companies that are making a go of it alone are having success. Foundry Networks, ranked 133 on the NW200, ran revenue up 684% last year to $134 million, and Extreme, which ranked 149, ratcheted sales up 316% to $98 million.

The gigabit boom is part of a larger bandwidth explosion. In the wide area, companies have largely replaced 56K bit/sec frame relay access pipes with 128K and 256K bit/sec links, and in many cases, T-1. And Internet access at OC-3 is much more common than it used to be.

The thirst for bandwidth can be seen in the digital subscriber line (DSL) bonanza, too. Copper Mountain, the leading supplier of equipment that carriers use to deliver DSL services to business users, installed 3,700 port concentrators in 1999, bringing the company's installed base to 4,600 systems, says Rick Gilbert, president and CEO. That corresponds to about 850,000 DSL ports, some 573,500 of which were installed last year alone. (Copper Mountain isn't on the NW200 because it doesn't sell directly to enterprise customers.)

What's driving the demand for bandwidth, of course, is the mad dash to doing business online, everything from Web storefronts to using extranets to collaborate with business partners and customers. The resultant demand for infrastructure, applications and services is contributing to the growth of practically every company on the NW200.

The same confluence of developments that make this online business phenomenon possible — inexpensive, plentiful bandwidth, the browser as a universal front end and the ubiquity of IP — can also be credited with paving the way for the arrival of the application service provider (ASP) market.

It can be argued that the ASP market was conceived in September 1998 with the creation of Corio. Company founder Jonathan Lee envisioned hosting high-end business applications and selling access to those applications to middle-market companies that otherwise couldn't buy or manage them.

His vision was compelling enough to Excite, which signed on as Corio's first customer in January 1999, a seminal event in the nascent market. By year-end, Corio had 45 customers and had proved the ASP concept.

Lee, who gave his ASP idea a 1-in-10 chance of succeeding, was as surprised as anyone at how fast the market came to life. By year-end, all segments of the IT industry, from carriers and Web-hosting firms to major software and hardware companies, had embraced the concept. "By the end of '99, this . . . had turned it into a global phenomenon," he says.

Just last month, the ASP Industry Consortium added its 400th member. "It took six months to add our first 200 members, but only four months to add the second 200," says Traver Gruen-Kennedy, the group's chairman (see www.allaboutasp.org/).

While little ASP activity can be detected on the NW200 today, many traditional companies are hard at work honing their ASP stories. Microsoft, for example, recently announced a $10 million investment in Interliant to host Windows 2000 server and Exchange 2000 messaging, and another $10 million investment in Jato Communications to host applications for small to midsize businesses.

Those investments are a mere slice of the more than $10 billion Microsoft has spent since November 1998 in part to establish partnerships with ASPs and the broadband companies that sup-

Continued on **page 66**

INVESTING IN THE FUTURE

Companies that spend the most on R&D.

1999 Rank	Company	R&D as % of 1999 revenue
165	Inktomi	38%
104	Corel	34%
198	Vixel	33%
144	Auspex Systems	31%
134	RealNetworks	29%
150	Tibco	29%
138	New Era of Networks	28%
177	Cylink	27%
160	Open Market	27%
170	BindView	25%
120	Inprise/Borland	24%
45	National Semiconductor	24%
145	Axent Technologies	24%
182	ACT Networks	24%

HOT GROWTH COMPANIES

Fastest-growing companies 1998-1999.

1999 Rank	Company	Revenue (in millions) 1998	1999	'98-'99 % Δ
173	Covad Communications	$5	$66	1,148%
187	Interliant	$5	$47	861%
133	Foundry Networks	$17	$134	684%
105	Exodus Communications	$53	$242	359%
149	Extreme Networks	$24	$98	316%
103	Epicor Software	$64	$258	307%
165	Inktomi	$20	$71	249%
72	Veritas Software	$211	$700	232%
141	Beyond.com	$37	$117	220%
168	Brocade Communications	$24	$69	183%
181	Allaire	$21	$55	158%
73	Comverse Technology	$280	$696	148%
110	Network Solutions	$94	$221	136%
76	EarthLink	$291	$670	131%
196	Nstor Technologies	$18	$41	128%

Fastest-growing companies 1994-1999.

1999 Rank	Company	Revenue (in millions) 1994	1999	'94-'99 CAGR*
70	Siebel Systems	$0.10	$791	502%
76	EarthLink	$0	$670	482%
138	New Era of Networks	$0.10	$126	317%
128	Concentric Network	$0	$147	226%
111	Check Point Software	$1	$220	208%
143	BroadVision	$0.54	$116	192%
96	Network Appliance	$2	$289	165%
62	McLeodUSA	$8	$909	158%
63	Intermedia Communications	$14	$906	129%
154	Open Text	$2	$93	125%
37	Qwest Communications	$71	$3,928	123%
85	Premiere Technologies	$8	$458	123%
72	Veritas Software	$15	$700	115%
34	AOL	$104	$4,777	115%
110	Network Solutions	$5	$221	113%

*Compound annual growth rate

MANAGING PROFITS

Most profitable companies in 1999.

1999 Rank	Company	Profits as % of 1999 revenue
112	RSA Security	84%
189	Banyan	61%
111	Check Point Software	44%
14	Microsoft	39%
89	Citrix Systems	29%
53	BMC Software	28%
10	Intel	25%
44	Tellabs	24%
60	Adobe Systems	23%
154	Open Text	22%
48	Compuware	21%
58	Century Tel	21%
172	Concord Communications	20%
80	Sterling Commerce	20%
147	Apex PC Solutions	20%

Largest increase in profits 1998-1999.

1999 Rank	Company	1998-1999 % Δ
129	Brooktrout	5,652%
189	Banyan	2,418%
139	Dot Hill Systems	1,441%
30	3Com	1,237%
179	Micromuse	841%
112	RSA Security	525%
122	Ardent Software	425%
143	BroadVision	366%
5	Lucent	360%
195	SpectraLink	282%
7	MCI WorldCom	211%
94	Inter-Tel	201%
28	NCR	176%
120	Inprise/Borland	172%
73	Comverse Technology	156%

Largest increase in profits 1994-1999.

1999 Rank	Company	1994-1999 CAGR*
111	Check Point Software	425%
89	Citrix Systems	258%
166	Quest Software	189%
34	AOL	162%
112	RSA Security	140%
157	Entrust Technologies	127%
60	Adobe Systems	107%
95	Cognos	81%
147	Apex PC Solutions	70%
170	BindView	70%
36	Qualcomm	68%
50	PeopleSoft	65%
191	Performance Technologies	64%
57	Perot Systems	64%
107	Remedy	57%

*Compound annual growth rate

Profits for the NW200 were up **39%** from $55.3 billion in 1998 to $76.9 billion in 1999 (versus a decline of 1.8% from '97 to '98).

Profitable PKIs

Public-key infrastructure vendor RSA Security leads the Network World 200 ranks in profit as a percentage of revenue.

An Internet company making a profit? And a sizable one at that? You bet, if you're talking about RSA Security, the result of the merger of Security Dynamics and RSA Data Security.

RSA Security turned in an amazing 1999 performance, earning $184 million in profit on its $218 million in revenue. In other words, for every dollar it brought in, slightly more than 84 cents was profit. That sent it to the top of our list of the most profitable Network World 200 companies.

The secret is investing, says Arthur Coviello, CEO at RSA Security in Bedford, Mass.

At the close of 1999, RSA owned $5.5 million worth of VeriSign shares. Big returns on those shares boosted the company's profitability tremendously, Coviello says. If calculating only operational profit, RSA would have landed at 12.4% of profit per revenue. Most of that additional 70% and up came from realizing big returns on the VeriSign shares, he explains.

And as of March 31, RSA increased its stake in VeriSign with another $5 million in shares. That means that Coviello expects to boost shareholder returns even more over the next 11 quarters, reaping $25 million from its additional VeriSign stock alone. Likewise, RSA expects to realize $125 million from its $5 million investment in e-commerce payment system maker Trintech.

MATTHEW MCKEE

CEO Arthur Coviello leads the most profitable company on the NW200: RSA Security.

RSA's encryption licensing business, which accounts for about 20% of revenue, provides an inside scoop on emerging companies. "Inktomi, Akamai, Ariba, Commerce One — they all came to us very early in their development for licensing of RSA technology. It gives us an attractive window into the next high-flying start-up," Coviello explains.

So much so that in January, RSA launched RSA Capital, with $100 million to dole out. "We've formed an investment subsidiary to formalize what we've been doing on an ad hoc basis over the last several years," Coviello says. Not only will RSA Capital seed hot prospects that wander in the door seeking OEM agreements, but also actively search for young bloods to fund.

Yet none of this should minimize RSA's solid operating performance, which for 1999 was in itself an Internet example.

"If you weed through the financial bits and pieces, you'll see an operating profit of $27 million," Coviello points out. That's an important part of the financial health of a company. By running itself profitably, he adds, the company shows that it has the stamina to support customers and continue to innovate.

— Julie Bort

Continued from page 63

ply the bandwidth needed to serve up applications.

As 2000 unfolds, we'll see a slew of new ASP activity, and by this time next year, don't be surprised if Corio and other pure-play ASPs have elbowed their way onto the NW200.

Carrier gyrations

One company that has played its ASP card is AT&T. In January, the company introduced its Ecosystem for ASP strategy, under which it will build network-ready data centers that ASPs can use to deliver their services.

AT&T has five centers in operation and plans to have 26 more online by the end of next year. It will outfit the centers with servers and equipment from partners such as Cisco, EMC, Hewlett-Packard, InfoLibria, Inktomi, Novell and Sun.

Responding fast to market opportunities is becoming the hallmark of AT&T Chairman and CEO C. Michael Armstrong. And the numbers show it. Revenue for 1999 was up a whopping 17% to $62.3 billion, even though profit dipped 15% to $5.5 billion as the company funded a range of efforts.

Earnings performance aside, Wall Street seems to like what Armstrong is doing. After finishing 1998 behind MCI WorldCom, AT&T's market cap rocketed in front of MCI WorldCom's in 1999 — $174.4 billion vs. $135 billion.

AT&T has been hard at work. AT&T Business Services remains the company's largest revenue engine — sales of packet service were up 60% last year — but AT&T Solutions, the company's managed services arm, is no slouch. That unit ended 1999 with more than 30,000 clients and $11 billion in signed contracts.

Just as inspiring, AT&T says last year it nearly doubled the size of TCG, the CLEC it bought in 1998, by adding more lines in a single year than TCG had installed in its history. The goal is to reach almost 60% of the business market by year-end.

VALUE PACKED

Highest-valued companies.

1999 Rank	Company	Market cap* (in millions)
14	Microsoft	**$500,320**
19	Cisco	**$470,200**
10	Intel	**$398,410**
21	Oracle	**$228,370**
5	Lucent	**$226,310**
1	IBM	**$194,680**
2	AT&T	**$174,350**
20	Sun	**$171,860**
13	Nortel Networks	**$164,080**
3	SBC Communications	**$155,430**
4	Hewlett-Packard	**$138,830**
7	MCI WorldCom	**$135,000**
34	AOL	**$131,490**
26	EMC	**$119,680**
16	Dell	**$118,640**

* Value of outstanding shares as of March 3, 2000.

EMPLOYEE BOOM

Companies adding employees fastest, 1998-1999.

1999 Rank	Company	Employees '98 - '99% Δ
196	Nstor Technologies	**669.23%**
87	Excite@Home	**311.40%**
131	Peregrine Systems	**223.53%**
72	Veritas Software	**214.81%**
138	New Era of Networks	**163.60%**
105	Exodus Communications	**154.24%**
143	BroadVision	**153.51%**
142	ISS Group	**151.52%**
103	Epicor Software	**148.40%**
141	Beyond.com	**118.98%**
199	Applied Theory	**116.84%**
139	Dot Hill Systems	**116.05%**
166	Quest Software	**111.73%**
110	Network Solutions	**107.79%**
76	EarthLink	**95.38%**

AT&T's expensive and bold gamble on cable TV as a medium for delivering integrated two-way services is also beginning to pay off. Last year, the company introduced cable telephony service in 16 communities.

In its annual report (www.att.com/ar-1999/dear.html), AT&T stated: "As 2000 started, we were installing broadband services at a rate of 5,000 homes per day. We plan to ramp that up to 10,000 installations per day by the end of the year."

So sure is AT&T of its new destiny that Armstrong wrote in passing in his annual shareholder letter: "While our voice long-distance revenue will decline as a percent of total revenue, we expect our packet services [including IP] and local service revenue growth will outpace the industry."

A few years ago, that kind of statement would have made the company's elder stockholders faint.

One carrier constituency that is perhaps getting a little weak in the knees is the customer base of MCI WorldCom. According to many reports, MCI WorldCom is an integrated company in name only. It has had trouble blending all the assets acquired over the years by CEO Bernard Ebbers.

And now Ebbers is after the biggest fish of all. Last October, the company announced a $115 billion Sprint buyout, a deal that many customers and investors are still finding tough to swallow. The merger is supposed to be finalized in the second half of this year.

Other than that proposed alliance, one of the more significant telecom developments of the year happened right at the end. On Dec. 22, Bell Atlantic got approval to enter the long-distance business.

Of course, this is significant as a milestone only. It will be some time before it and similar decisions start to reshape the industry. To date, the most important change that has resulted from the passing of the Telecommunications Act of 1996 is the rise of the CLEC market.

Continued on **page 68**

Counting heads

Employee count at Nstor Technologies and Excite@Home grew the most among Network World 200 companies.

Can't hire the talent you need? Buy it. That tactic landed Nstor Technologies and Excite@Home on top of the Network World 200 chart for employee growth in 1999. Through acquisitions, these companies expanded their workforces 669% and 311%, respectively.

Nstor, a small player in the storage-area network arena, wanted Andataco, a competitor, for its direct sales force. So the 26-employee firm bought the larger, roughly 200-employee company, keeping all but a few of the acquired people.

"We knew to gain a channel of distribution, we really needed an acquisition," says Larry Hemmerich, CEO at Nstor.

For Excite@Home, employee count went from 570 to 1,775. Obviously, the @Home merger in January 1999 accounted for a big chunk, about doubling the number of employees. But that was only the start, says Marc Ketzel, vice president of global human resources programs. The company completed another half-dozen acquisitions, each adding anywhere from five to several hundred people. "We pretty much kept 100% of acquired employees, with the exception of senior management," Ketzel says.

Along with bringing in new employees, the @Home merger increased the number of Excite's broadband customers from 300,000 to 1.1 million. Naturally, Excite@Home beefed up its customer support, engineering and sales departments, and added administration folk and content producers.

Interestingly, despite Nstor's and Excite@Home's drastic expansions in 1999, neither is a model of solvency. Both continue to lose money on operations, despite growing revenue.

— Julie Bort

ROBERT BURROUGHS

Nstor Technologies CEO Larry Hemmerich grew his crew by 669% last year.

CORIO

APPLICATIONS ON DEMAND

SECRETS TO SUCCESS: No. 210

Joel Maske, President & CEO, iSyndicate, Inc.

How do we manage our growth?

We hired Corio.

When iSyndicate experienced their incredible growth, they knew they would need to find a more scalable, robust and integrated financial solution. They hired Corio. Corio Express Financials is hosted PeopleSoft financials–up and running in two weeks–for a low monthly fee and no up-front implementation cost. Now, iSyndicate has a financial application that meets their complex business needs, but has familiar reports and forms as found in an easy to use off the shelf package. So, if you've outgrown Quickbooks, hire Corio. iSyndicate did.

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Continued from page 66

As noted, investment here is large and carriers are having success landing business. Covad Communications' revenue was up 1,148% from $5 million to $66 million last year, landing it on the top of our Fastest-Growing Companies chart (see story, page 62). WinStar revenue was up 82% to $446 million, and Nextlink sales were up 96% to $274 million.

E-comm advances

It is relatively easy to wrap your hands around an industry like telecom. But just try getting a handle on something as amorphous as e-commere, one of the hottest stories of 1999.

Open Market (160 on the NW200 list) and some other sizable companies specialize in this market. But the fact is the bulk of the NW200 are involved in some fashion or another — from IBM to Microsoft to Oracle to Compaq.

The fortunes of these and other vendors have been strengthened by corporate America's push to do more business online, but trying to calculate how much e-commerce can be credited with industry growth is difficult.

The Center for Research in Electronic Commerce at the University of Texas' Graduate School of Business set out in 1998 to better understand that. It conducted a survey, sponsored by Cisco, meant to gauge the economic growth and the number of jobs created by the so-called Internet economy.

For the survey, the Center segmented the Internet economy into four layers and identified

Market capitalization of the NW200 has passed $5 trillion.

and studied companies in each layer (some companies participated in more than one layer). The breakdowns were:

- The infrastructure layer, for carriers and vendors of products such as servers and security devices.
- The application layer, for

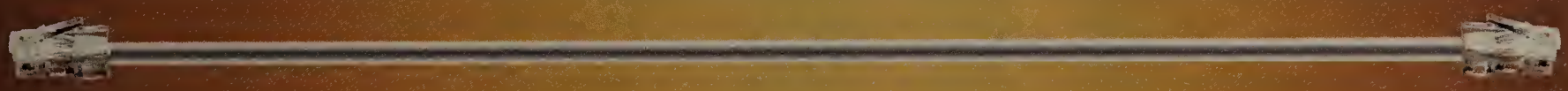
Continued on **page 72**

ALPHABETICAL COMPANY LISTING

Company	1999 Rank	Company	1999 Rank	Company	1999 Rank	Company	1999 Rank	Company	1999 Rank
3Com	30	Check Point Software	111	FVC.com	190	NetManage	161	Remedy	107
ACT Networks	182	Cisco	19	Gateway	22	Netopia	192	RSA Security	112
Active Voice	176	Citrix Systems	89	General DataComm	121	NetScout Systems	171	SAP	33
Adaptec	74	Cognos	95	GTE	11	Network Appliance	96	SBC Communications	3
ADC Telecommunications	46	Comdial	127	Harbinger	124	Network Associates	75	Scientific Atlanta	55
Adobe Systems	60	Commscope	71	Hewlett Packard	4	Network Computing Devices	146	SCM Microsystems	137
Adtran	91	Compaq	6	Hughes Electronics	31	Network Equipment Techs.	101	Seagate Technology	25
Allaire	181	CompuCom Systems	40	Hypercom	102	Network Solutions	110	Segue Software	188
Alltel	27	Computer Associates	32	IBM	1	New Era of Networks	138	Siebel Systems	70
AOL	34	Computer Network Tech.	125	ICG Communications	84	Newbridge Networks	56	Silicon Graphics	41
American Power Conversion	52	Computer Sciences	23	Informix	66	Nextlink	100	SpectraLink	195
Analysts International	78	Compuware	48	Inktomi	165	Norstan	83	Sprint	17
Andrew	69	Comverse Technology	73	Inprise/Borland	120	Nortel Networks	13	Standard Microsystems	123
Anixter	42	Concentric Network	128	Intel	10	Novell	54	Sterling Commerce	77
Apex PC Solutions	147	Concord Communications	172	Interliant	187	Nstor Technologies	196	Sterling Software	68
Apple	29	Corel	104	Intermedia Communications	63	ODS Networks	180	Storage Technology	43
Applied Theory	199	Covad Communications	173	Interphase	164	Open Market	160	Sun	20
Ardent Software	122	Cylink	177	Inter Tel	94	Open Text	154	SunGard Data Systems	49
Asante	200	Datalink	140	InterVoice Brite	132	Oracle	21	Sybase	65
Aspect Communications	82	Datapoint	130	ISS Group	142	Osicom Technologies	152	Symantec	79
Aspect Development	151	Davox	155	J.D. Edwards	61	PeopleSoft	50	Symbol Technologies	59
AT&T	2	Dell	16	JetForm	162	Peregrine Systems	131	Syntellect	186
Auspex Systems	144	Digi International	115	Larscom	183	Performance Technologies	191	Tektronix	47
AVT	135	Digital Microwave	106	Level 3 Communications	81	Perle Systems	193	Tellabs	44
Axent Technologies	145	Documentum	136	Lexmark International	39	Perot Systems	57	Telxon	90
Banyan	189	Dot Hill Systems	139	Lucent	5	PictureTel	93	The Santa Cruz Operation	108
BEA Systems	97	EarthLink	76	MCI WorldCom	7	Pitney Bowes	35	Tibco	150
Belden	67	ECCS	197	McLeodUSA	62	Polycom	114	Unisys	24
Bell Atlantic	8	EDS	15	Mercury Interactive	117	Premiere Technologies	85	US West	18
BellSouth	12	EMC	26	Micromuse	179	Printronix	118	Verilink	178
Beyond.com	141	Emulex	169	Micron Technology	38	Procom Technology	148	VeriSign	158
BindView	170	Entrust Technologies	157	Microsoft	14	Prodigy Communications	116	Veritas Software	72
BMC Software	53	Epicor Software	103	Microtest	194	Progress Software	99	Verity	174
BroadVision	143	eShare Technologies	153	Mitel	64	Proxim	167	Visual Networks	156
Brocade Communications	168	Exabyte	109	Mobius Mgmt. Systems	163	PSINet	80	Vixel	198
Brooktrout	129	Excite@Home	87	Motorola	9	Qualcomm	36	Vodavi Technology	185
Cabletron	51	Exodus Communications	105	MRV Communications	98	Quest Software	166	VTEL	126
Centigram Communications	159	Extreme Networks	149	MTI Technology	113	Qwest Communications	37	WinStar	86
Centura Software	184	FileNet	92	National Semiconductor	45	RealNetworks	134	Xircom	88
Century Tel	58	Foundry Networks	133	NCR	28	Remec	119	Zoom Telephonics	175

[works like this]

Open the LAN floodgates



[looks like this]

(no re-plumbing necessary)

Slide a blade into your FastIron II or BigIron high performance switch or router chassis, slip a network interface card into your desktops, and stand back. Because in three easy steps, you've turned a 10/100Base-TX trickle into a Gigabit tidal wave. Without pulling an inch of wire.

Foundry Networks Gigabit Ethernet Over Copper technology brings 1000Base-T performance to the desktop through your existing Cat-5 cabling plant. There's no network magic to work. No fiber cabling to pull. And virtually zero network downtime.

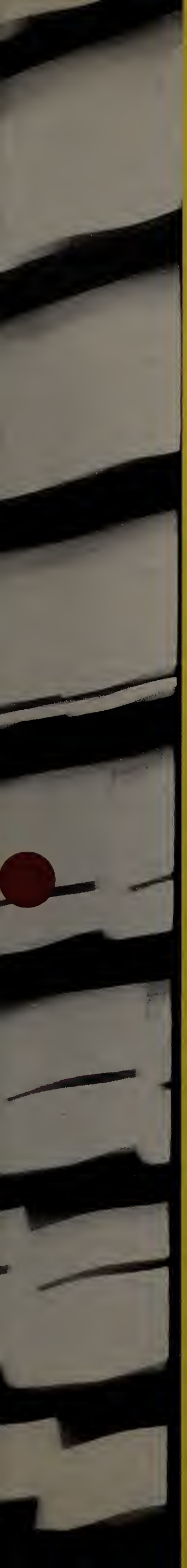
So if your business is ready for the rush of pure, free-flowing data, Foundry Networks is your Gigabit pipeline to **IronClad Network Performance**. Visit us online at www.foundrynetworks.com/nw1, email info@foundrynet.com or call 1-888-TURBO-LAN (887-2652).

FastIron II Plus GC

FastIron II GC

FOUNDRY NETWORKS

I am data



I am data.

Yesterday I was just numbers on paper.

Today I am the lifeblood of business.

I am the genetic material

that flows between companies

to create products,

deliver service,

build companies,

enhance life.

And I am forever

committed to commerce.

Who is committed to me?

We're investing 6 billion dollars in the most far-reaching deployment of broadband out there. We're one of the largest network integrators, and a provider of advanced, global eCommerce solutions. We're SBC. The combined strengths of Ameritech, Pacific Bell, Southwestern Bell, SNET and now Sterling Commerce. You're demanding more. **Start expecting more.**

SBC

sbc.com

Continued from page 68

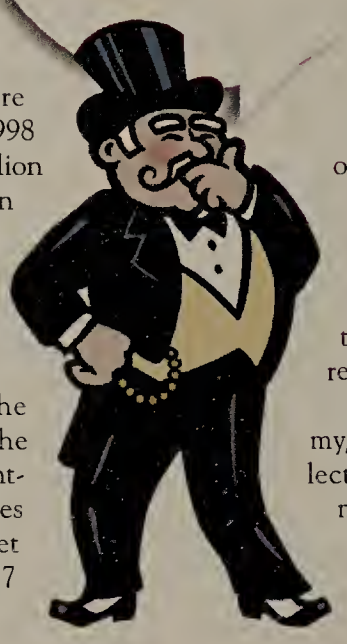
vendors of applications ranging from search engines to Web development and multimedia tools to databases.

- The intermediary layer, for companies like Yahoo that facilitate the meeting of buyers and sellers.
- The commerce layer, for companies selling online, be it Amazon.com or Cisco.

NW200 companies are best represented in the infrastructure and application layers. The Center says the infrastructure layer grew 50% from first-quarter 1998 to first-quarter 1999, from $26.8 billion to $40.1 billion. The application layer was up 61%, from $13.9 billion to $22.5 billion. The fastest-growing of all was the commerce layer, which shot up 127%, from $16.5 billion to $37.5 billion.

All told, the Center says the Internet economy grew 68% for the period and as of April 1999, accounted for 2.3 million jobs. It estimates that by the end of 1999, the Internet economy accounted for some $507 billion in economic activity.

Average revenue per employee of the collective NW200: $279,161.



That seems high when you consider that collectively the NW200 generated $809.6 billion in revenue last year. But bear in mind that the $507 billion figure is inflated by companies like E*Trade, eToys, Schwab.com and others that obviously don't fit into the NW200.

Empirically, however, it seems reasonable that the Internet economy grew 68% for that 1998-1999 period. Given the success of the NW200 last year, we would expect the figure for 1999-2000 to be even better.

If nothing else, all of these reflections on the fortunes of the NW200 reinforce what you already know about industry trends. It isn't surprising that the NW200 as a group is surging forward on this "networked business" wave and that the stock market is handsomely rewarding companies on the list.

But how is this for a little "new economy/old economy" perspective: While collectively NW200 companies are worth more than $5 trillion, according to a March 15 *Wall Street Journal* article called "Shareholders catch a slow train to the 21st century," the entire U.S. railroad industry is worth only $30 billion.

That's the same market cap of Network Appliance, 96 on the NW200 list with 1999 revenue of $289 million. ◪

PRODUCTIVITY

Companies with the most revenue per employee.

1999 Rank	Company	Revenue per employee in 1999
147	Apex PC Solutions	**$1,192,089**
140	Datalink	**$880,719**
16	Dell	**$747,664**
29	Apple	**$630,033**
14	Microsoft	**$628,965**
40	CompuCom Systems	**$582,378**
19	Cisco	**$578,762**
114	Polycom	**$552,671**
133	Foundry Networks	**$540,575**
169	Emulex	**$518,939**
4	Hewlett-Packard	**$502,014**
116	Prodigy Communications	**$479,792**
22	Gateway	**$455,030**
6	Compaq	**$452,703**
30	3Com	**$443,091**

Simple Web Truth #3

YOU CAN NEVER HAVE *Too Much* CONTROL

Run fast, grow like crazy and never lose control.

This is the model for most companies doing business on the Web today. Well, except the control part. Everyday another online outage makes headlines. So how do you stay out of the news? The companies below know. Webworking from Alteon WebSystems.

Finally Web-intelligent networking (Webworking)

Webworking combines Web-intelligent traffic control services with ultra-fast Ethernet switching.

Add or remove servers to scale capacity—while sites stay up. Control and prioritize bandwidth between different sites, applications or users.

Get all the power and control you ever wanted with our Web data center switches and Web OS software. Local and global server load balancing, content-aware switching, bandwidth management. All at line rates. All in one box.

Alteon 700 Series Web data center switches are the only way to keep your data moving at full Web speed.

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Web Speed for e-Business

Rank			1999 revenue				1999 profit/loss				Mkt. cap.		Cash and	Number of employees			Rev. per	R&D		
1999	1998	Company	$M	'98-'99 % Δ	'94-'99 CAGR	Int'l %	$M	'98-'99 % Δ	% of rev.	'94-'99 CAGR	$M 3/3/00	Stock symbol	invest $M	1999	'98-'99 % Δ	'94-'99 CAGR	employee 1999	% rev. 1998	% rev. 1999	Year Inc.
1	1	IBM	87,548	7%	6%	58%	7,712	22%	9%	21%	194,680	IBM	5,831	307,401	5.61%	7%	$284,801	5%	5%	1914
2	2	AT&T	62,391	17%	-4%	2%	5,450	-15%	9%	3%	174,350	T	1,024	147,800	37.11%	-13%	$422,131			1877
3	9	SBC Communications	49,489	7%	34%		8,159	6%	16%	38%	155,430	SBC	495	204,530	2.07%	28%	$241,965			1995
4	3	Hewlett-Packard	42,370	7%	11%	55%	3,491	19%	8%	17%	138,830	HWP	5,590	84,400	-32.26%	-3%	$502,014	6%	6%	1983
5	7	Lucent	38,700	21%		32%	4,766	360%	12%		226,310	LU	1,816	153,000	8.05%		$252,941	12%	12%	1996
6	5	Compaq	38,525	24%	29%	54%	569		1%	-8%	44,730	CPQ	3,302	85,100	19.86%	43%	$452,703	4%	4%	1982
7	6	MCI WorldCom	33,341	16%	72%	5%	3,865	211%	12%		135,000	WCOM								1969
8	4	Bell Atlantic	33,174	5%	19%	4%	4,202	42%	13%		85,890	BEL	1,936	145,416	3.87%	15%	$228,132			1877
9	8	Motorola	30,931	5%	7%	63%	817		3%	-12%	106,780	MOT	4,044	121,000	-9.02%	-2%	$255,628	10%	11%	1928
10	10	Intel	29,389	12%	21%	57%	7,314	21%	25%	26%	398,410	INTC	11,788	70,000	8.53%	17%	$419,843	10%	11%	1968
11	11	GTE	25,336	9%	5%	7%	3,412	15%	13%	7%	63,650	GTE	4,868	100,000	-16.67%	-2%	$253,360	1%	1%	1935
12	12	BellSouth	25,224	9%	8%	9%	3,448	-2%	14%	10%	86,560	BLS	1,392	96,162	8.78%	1%	$262,307			1878
13	13	Nortel Networks	22,217	26%	20%		(170)				164,080	NT	2,160	70,000	-6.73%	4%	$317,386	14%	13%	1998
14	17	Microsoft	19,747	29%	34%	60%	7,785	73%	39%	47%	500,320	MSFT	22,211	31,396	16.05%	16%	$628,965	17%	15%	1975
15	15	EDS	18,534	10%	13%		421	-43%	2%	-13%	30,720	EDS	729	120,000		11%	$154,450			1962
16	19	Dell	18,243	48%	45%	36%	1,460	55%	8%		118,640	DELL	520	24,400	52.50%	32%	$747,664	2%	1%	1984
17	16	Sprint	17,016	8%	6%		1,567	2%	9%	12%	60,990	FON	120	77,600	19.57%	9%	$219,278			1899
18	18	US West	13,182	6%	4%		1,102	-24%	8%	-5%	38,120	USW	78	58,272	6.95%	3%	$226,215			1983
19	21	Cisco	12,154	43%	56%	43%	2,096	55%	17%	45%	470,200	CSCO	2,016	21,000	40.00%	54%	$578,762	12%	13%	1984
20	20	Sun	11,726	20%	20%	5%	1,031	35%	9%	39%	171,860	SUNW	2,665	29,000	10.27%	17%	$404,345	10%	11%	1982
21	24	Oracle	8,827	24%	35%	49%	1,290	59%	15%	35%	228,370	ORCL	2,563	43,800	19.02%	29%	$201,535	10%	10%	1977
22	22	Gateway	8,646	16%	26%	15%	428	24%	5%	35%	22,040	GTW	1,128	19,000	-1.55%	28%	$455,030			1985
23	26	Computer Sciences	7,660	16%	24%	36%	341	31%	4%	29%	12,870	CSC	603	50,000	11.11%	12%	$153,199			1959
24	23	Unisys	7,545	4%	1%	55%	511	36%	7%	38%	8,700	UIS	464	35,800	7.83%	-5%	$210,743	4%	4%	1986
25	25	Seagate Technology	6,802		14%	49%	1,176		17%	39%	11,840	SEG	1,623	82,000	-5.75%	14%	$82,951	9%	9%	1979
26	34	EMC	6,716	24%	37%	31%	1,180	50%	18%	36%	119,680	EMC	1,824	16,000	64.95%	37%	$419,726	8%	9%	1979
27	31	Alltel	6,302	21%	16%	2%	822	36%	13%	25%	19,130	AT	18	24,440	13.65%	8%	$257,867			1983
28	27	NCR	6,196	-5%	-6%	57%	337	176%	5%		3,610	NCR	763	32,800	-0.91%	-7%	$188,902	6%	5%	1884
29	28	Apple	6,134	3%	-8%	45%	601	94%	10%	14%	20,690	AAPL	3,226	9,736	0.76%	-8%	$630,033	5%	5%	1977
30	30	3Com	5,772	6%	47%	47%	404	1,237%	7%		28,440	COMS	1,662	13,027	0.83%	41%	$443,091	11%	11%	1979
31	60	Hughes Electronics	5,560	60%	-17%		(270)				16,930	GMH	238					3%		1932
32	32	Computer Associates	5,253	11%	20%	38%	626	-46%	12%	9%	32,790	CA	399	14,650	28.51%	16%	$358,567	8%	8%	1976
33	43	SAP	4,931	18%	33%	58%	581	14%	12%	26%	55,075	SAP	782	21,699	12.38%		$227,229	4%	5%	1988
34	40	AOL	4,777	55%	115%		762		16%	162%	131,490	AOL	1,424	12,100	42.35%	87%	$394,793	8%	6%	1992
35	33	Pitney Bowes	4,433	8%	6%		636	10%	14%	18%	13,490	PBI	257					2%	2%	1912
36	35	Qualcomm	3,937	18%	71%	38%	201	85%	5%	68%	93,400	QCOM	1,614	9,700	-16.38%	39%	$405,907	10%	10%	1968
37	46	Qwest Communications	3,928	75%	123%		459		12%		47,870	Q	349							1988
38	37	Micron Technology	3,764	24%	18%	29%	(69)				25,270	MU	1,614	15,700	37.72%	24%	$239,745	9%	9%	1978
39		Lexmark International	3,452	14%	13%		319	31%	9%	48%	15,310	LXK	94	10,000	13.64%	15%	$345,230	5%	5%	1978
40	45	CompuCom Systems	2,912	29%	18%		12	-97%		-51%	242	CMPC	14	5,000	4.17%	20%	$582,378			1981
41	36	Silicon Graphics	2,749	-11%	13%	44%	54		2%	-17%	1,740	SGI	688	9,191	-10.65%	16%	$299,092	15%	14%	1981
42	42	Anixter	2,670	14%	9%	25%	124	89%	5%	-13%	728	AXE								1957
43	44	Storage Technology	2,368	5%	8%	41%	(75)				1,240	STK	215	8,000	-8.05%	-5%	$296,029	10%	12%	1969
44	49	Tellabs	2,319	36%	36%	30%	559	41%	24%	51%	21,900	TLAB	966	7,000	40.56%	22%	$331,357	13%	13%	1975
45	41	National Semiconductor	1,957	-23%	-3%	34%	(1,010)				13,390	NSM	526	11,600	-10.77%	-12%	$168,690	19%	24%	1959
46	55	ADC Telecommunications	1,927	25%	34%	23%	88	-50%	5%	18%	14,250	ADCT	294	13,500	68.75%	39%	$142,737	10%	10%	1935
47	47	Tektronix	1,861	-11%	7%	49%	(51)				2,990	TEK	40	7,571	-12.27%	-2%	$245,871	10%	11%	1946
48		Compuware	1,638	44%	38%		350	80%	21%	43%	7,570	CPWR	193	10,908	25.91%	32%	$150,206	5%	4%	1973
49		SunGard Data Systems	1,445	10%	27%		111	-15%	8%	21%	4,060	SDS	391	5,200	-1.89%	16%	$277,789	10%	9%	1978
50		PeopleSoft	1,429	-3%	66%		178	24%	12%	65%	5,000	PSFT	704	7,632	8.53%	64%	$187,257	16%	21%	1987
51	54	Cabletron	1,411	2%	19%	41%	(245)				9,090	CS	159	5,951	-13.59%	10%	$237,153	13%	15%	1983
52	58	American Power Conversion	1,337	19%	29%	47%	206	40%	15%	24%	6,520	APCC	456	5,290	-2.81%	22%	$252,798	3%	3%	1981
53	72	BMC Software	1,304	32%	35%	39%	363	92%	28%	45%	11,720	BMCS	348	4,914	76.95%	38%	$265,339	13%	13%	1980
54	59	Novell	1,273	17%	-9%	36%	191	87%	15%	-2%	10,490	NOVL	895	5,629	24.81%	-7%	$226,118	22%	18%	1980
55	57	Scientific-Atlanta	1,243	5%	9%		102	27%	8%	24%	10,590	SFA	300	6,502	13.35%	10%	$191,245	9%	9%	1951
56	50	Newbridge Networks	1,230	10%	35%		123		10%	9%	6,250	NN	604	6,530	3.06%	25%	$188,422	16%	15%	1986
57		Perot Systems	1,152	16%	32%		76	86%	7%	64%	2,250	PER	295	7,000	16.67%	25%	$164,514			1988
58	51	Century Tel	1,143	5%	16%		240	5%	21%	19%	4,910	CTL	57							1930
59	63	Symbol Technologies	1,139	17%	20%	36%	116	22%	10%	27%	9,070	SBL	30	4,500	21.62%	14%	$253,111			1973
60	66	Adobe Systems	1,015	13%	8%	51%	238	126%	23%	107%	10,830	ADBE	499	2,760	2.99%	12%	$367,911	23%	19%	1982
61		J.D. Edwards	944	1%		39%	(39)				4,200	JDEC	176	5,669	14.53%		$166,560	10%	12%	1977
62	77	McLeodUSA	909	50%	158%		(220)				13,240	MCLD		8,100	45.34%		$112,197			1991
63	75	Intermedia Communications	906	27%	129%	3%	(508)				3,420	ICIX	241	5,073	29.05%	102%	$178,593			1987
64	67	Mitel	900	49%	30%	53%	18	-71%	2%	12%	2,910	MLT	86	6,157	-5.81%		$146,236	6%	11%	1975
65	68	Sybase	872	0%	5%	40%	62		7%	-4%	2,430	SYBS	309	4,200	0.10%	1%	$207,532	17%	16%	1984
66	71	Informix	872	18%	13%		(12)				3,650	IFMX	229	3,672	-7.83%	11%	$237,346	20%	19%	1980
67	73	Belden	819	23%	13%	32%	36	4%	4%	-1%	554	BWC	4	5,400	14.89%	13%	$151,595	1%	1%	1902

Fiscal year ends	Web address	Chair	CEO	President	Products and services	Subsidiary and other notes
Dec	ibm	Louis Gerstner	Louis Gerstner		Wide range of computer products	Edmark, Lotus, Mylex, NetObjects, Sequent, Tivoli
Dec	att	C. Michael Armstrong	C. Michael Armstrong		Telecommunications services	Excite@Home
Dec	sbc	Edward Whitacre	Edward Whitacre	Royce Caldwell	Telecommunications provider	Southern Bell, Ameritech
Oct	hp	Lewis Platt	Carleton Fiorina	Carleton Fiorina	Wide range of computer products	Agilent, Dazel, VeriFone
Sep	lucent	Richard McGinn	Richard McGinn		Telecom equipment and software	SpecTran, International Network Services
Dec	compaq	Benjamin Rosen	Michael Cappellas	Michael Cappellas	Personal and high-end computers	AltaVista
Dec	wcom	Bert Roberts	Bernard Ebbers	Bernard Ebbers	Diversified telecommunications services	CAI, Embratel, SkyTel, UUNET, WorldCom
Dec	bellatlantic	Ivan Seidenberg	Ivan Seidenberg	Lawrence Babbio	Telecommunications services	
Dec	mot	Christopher Galvin	Christopher Galvin	Robert Growney	Cellular phones, semiconductors	
Dec	intel	Andrew Grove	Craig Barrett	Craig Barrett	Microprocessors	Dialogic, DSP Comm., Level One, Pandesic
Dec	gte	Charles Lee	Charles Lee	Kent Foster	Diversified telecommunications services	BCT.TELUS Communications
Dec	bellsouthcorp	F. Duane Ackerman	F. Duane Ackerman	F. Duane Ackerman	Telecommunications services	
Dec	nortelnetworks	Donald Schuenke	John Roth	John Roth	Switching and transmission equipment	
Jun	microsoft	William Gates	William Gates	Steven Ballmer	Operating systems, software, online services	Expedia, WebTV Networks
Dec	eds	Richard Brown	Richard Brown	Jeffrey Heller	Independent systems consulting	Unigraphics Solutions
Jan	dell	Michael Dell	Michael Dell		Personal computers and servers	
Dec	sprint	William Esrey	William Esrey	Ronald LeMay	Telecommunications services	American Telecasting, Call-Net Enterprises
Dec	uswest	Solomon Trujillo	Solomon Trujillo	Solomon Trujillo	Local voice and data networking	
Jul	cisco	John Morgridge	John Chambers	John Chambers	Networking and communication devices	
Jun	sun	Scott McNealy	Scott McNealy	Edward Zander	Unix workstations	
May	oracle	Lawrence Ellison	Lawrence Ellison	Raymond Lane	Database management systems software	Liberate Technologies
Dec	gateway	Theodore Waitt	Theodore Waitt	Jeffrey Weitzen	Personal computers	
Mar	csc	Van Honeycutt	Van Honeycutt	Van Honeycutt	Information technology services	
Dec	unisys	Lawrence Weinbach	Lawrence Weinbach	Lawrence Weinbach	Systems integration and support services	
Jun	seagate	G. Filler, L. Perlman	Stephen Luczo	Stephen Luczo	Storage drives for computers	Quinta
Dec	emc	Richard Egan	Michael Ruettgers	Joseph Tucci	Mainframe memory hardware and software	
Dec	alltel	Joe Ford	Joe Ford	Scott Ford	Telecommunications services	
Dec	ncr	Lars Nyberg	Lars Nyberg	Lars Nyberg	Point-of-sale systems	
Sep	apple		Steven Jobs		Personal computers	FileMaker
May	3com	Eric Benhamou	Eric Benhamou	Bruce Claflin	Networking products, personal connectivity	Palm
Dec	hughes	Michael Smith	Michael Smith		Satellites, wireless business networks	DIRECTV
Mar	cai	Charles Wang	Charles Wang	Sanjay Kumar	Networking and connectivity software	
Dec	SAP	H. Kagerman, H. Plattner	H. Kagerman, H. Plattner	Christopher Larson	Interenterprise software products	Pandesic
Jun	aol	Stephen Case	Stephen Case	Robert Pittman	ISP	CompuServe, The Knot
Dec	pitneybowes	Michael Critelli	Michael Critelli	Marc Breslawsky	Mailing equipment	
Sep	qualcomm	Irwin Jacobs	Irwin Jacobs	Richard Sulpizio	Wireless phones, GPS, e-mail software	
Dec	qwest	Joseph Nacchio	Joseph Nacchio	Afshin Mohebbi	Telecommunications services	
Aug	micron	Steven Appleton	Steven Appleton	Steven Appleton	Semiconductor memory components	ICF Kaiser Advanced Technology
Dec	lexmark	Paul Curlander	Paul Curlander	Paul Curlander	Computer printers	
Dec	compucom	Harry Wallaesa	Edward Coleman	Tom Lynch	Distributed net products, integration services	
Jun	sgi	Robert Bishop	Robert Bishop		High-end servers, advanced graphics computers	Alias/Wavefront
Dec	anixter	Samuel Zell	Robert Grubbs	Robert Grubbs	Distributor of networking products	
Dec	stortek	David Weiss	David Weiss	David Weiss	Storage systems	
Dec	tellabs		Michael Birck	Michael Birck	Data, video and voice equipment	
May	national	Brian Halla	Brian Halla	Brian Halla	Analog, digital and mixed-signal circuits	Cyrix
Oct	adc	William Cadogan	William Cadogan	William Cadogan	High-speed net gear	
May	tek	Jerome Meyer	Jerome Meyer	Jerome Meyer	Test and measurement equipment	Avstar Systems
Mar	compuware	Peter Karmanos	Peter Karmanos	Joseph Nathan	Testing, development, management software	
Dec	sungard	James Mann	James Mann	James Mann	Investment support systems	
Dec	peoplesoft	David Duffield	Craig Conway	Craig Conway	Business operations software	
Feb	cabletron	Piyush Patel	Piyush Patel	Piyush Patel	Routers and LAN switches	
Dec	apcc	Rodger Dowdell	Rodger Dowdell	Rodger Dowdell	Uninterruptible power supplies	
Mar	bmc	Max Watson	Max Watson	Max Watson	Software tools for corporate networks	
Oct	novell	Eric Schmidt	Eric Schmidt		Network operating system, directory services	
Jun	sciatl	James Napier	James McDonald	James McDonald	Transmission and distribution equipment	Atx Telecom Systems
Apr	newbridge	Terence Matthews	Terence Matthews	Pearse Flynn	Digital networking products	OST
Dec	perotsystems	Ross Perot	Ross Perot	Ross Perot	Technology consulting, systems management	
Dec	centurytel	Clarke Williams	Glen Post	Glen Post	Telecommunications services	
Dec	symbol	Jerome Swartz	Jerome Swartz	Tomo Razmilovic	Mobile data transaction systems	
Nov	adobe		John Warnock	Charles Geschke	Desktop publishing software	
Oct	jdedwards	C. Edward McVaney	Douglas Massingill	Douglas Massingill	Enterprise resource planning software	
Dec	mcleodusa	Clark McLeod	Clark McLeod	Stephen Gray	Telecommunications services	
Dec	intermedia	David Ruberg	David Ruberg	David Ruberg	Integrated communication services	Digex
Mar	mitel	Henry Simon	Kirk Mandy	Kirk Mandy	Computer telephony products	
Dec	sybase	John Chen	John Chen	John Chen	Relational database management systems	Visual Components
Dec	informix	Robert Finocchio	Jean-Yves Dexmier	Jean-Yves Dexmier	Database management systems	
Dec	belden-wire	C. Baker Cunningham	C. Baker Cunningham	C. Baker Cunningham	Cable and wire products	Alpha Wire

Rank			1999 revenue				1999 profit/loss				Mkt. cap.		Cash and invest	Number of employees			Rev. per employee	R&D		
1999	1998	Company	$M	'98-'99 % Δ	'94-'99 CAGR	Int'l %	$M	'98-'99 % Δ	% of rev.	'94-'99 CAGR	$M 3/3/00	Stock symbol	$M	1999	'98-'99 % Δ	'94-'99 CAGR	1999	% rev. 1998	% rev. 1999	Year Inc.
68	74	Sterling Software	$807	12%	11%		$(11)				2,900	SSW	319	3,700	5.71%	4%	$218,109	5%	5%	1981
69	69	Andrew	792	-7%	7%	52%	30	-71%	4%	-7%	2,210	ANDW	38	4,572	8.32%	9%	173,176	3%	4%	1947
70		Siebel Systems	791	93%	502%		122	116%	15%		28,660	SEBL	664					11%	9%	1993
71		Commscope	749	31%	11%	24%	68	74%	9%	9%	2,030	CTV	30	3,400	30.77%		220,269	1%	1%	1964
72		Veritas Software	700	232%	115%	21%	(503)				57,630	VRTS	692	2,975	214.81%	107%	235,294	19%	13%	1982
73	76	Comverse Technology	696	148%	59%	74%	112	156%	16%	54%	17,370	CMVT	648	3,220	14.06%	44%	216,178	5%	19%	1984
74	62	Adaptec	692	-31%	13%	57%	(13)				4,030	ADPT	318	2,123	-35.20%	6%	326,162	17%	21%	1981
75	64	Network Associates	684	-31%	83%	40%	(160)				3,980	NETA	786	2,700		84%	253,210	14%	22%	1989
76	115	EarthLink	670	131%	482%		(25)				2,890	ELNK	686	2,624	95.38%	227%	255,500			1994
77	82	Sterling Commerce	623	27%	32%	22%	124		20%	35%	3,490	SE	62	2,300			270,901	6%	6%	1996
78		Analysts International	620	6%	29%	1%	23	1%	4%	23%	290	ANLY	34	4,900	-7.55%	14%	126,562			1966
79	79	Symantec	593	11%	17%	40%	50	-41%	8%		4,310	SYMC	193	2,400	4.35%	15%	247,083	17%	17%	1982
80	101	PSINet	555	114%	105%	44%	(416)				7,200	PSIX	1,755	3,000	65.11%	88%	184,900	27%	16%	1988
81	87	Level 3 Communications	515	31%	-1%	3%	(487)				42,910	LVLT	3,446	3,856	-51.80%		133,558	8%		1884
82	81	Aspect Communications	489	-5%	27%	30%	(29)				3,150	ASPT	253	2,400	9.09%	30%	203,797	13%	18%	1985
83		Norstan	483	6%	16%	8%	6	53%	1%	1%	88	NRRD	1	2,657	-10.57%	9%	181,674			1973
84	97	ICG Communications	479	21%	34%		(234)			25%	1,740	ICGX	126	2,853	-16.46%	32%	167,964			1986
85		Premiere Technologies	458	3%	123%		(33)				440	PTEK	102					1%	3%	1991
86	105	WinStar	446	82%	77%		(638)				4,200	WCII	246	3,900	39.29%	112%	114,266	5%	5%	1983
87	124	Excite@Home	421	107%			(15)				12,000	ATHM	525	2,345	311.40%		179,318	23%	16%	1995
88	96	Xircom	409	48%	25%	51%	43	135%	11%	22%	1,540	XIRC	134	1,527	52.70%	38%	267,773	6%	6%	1988
89	104	Citrix Systems	403	62%	109%	37%	117	91%	29%	258%	19,420	CTXS	438	1,076	73.55%	71%	374,800	9%	9%	1989
90	84	Telxon	388	-16%	6%	27%	(137)				443	TLXN	22	1,501	-3.16%	-2%	258,690	8%	11%	1969
91	94	Adtran	367	28%	24%	3%	51	26%	14%	22%	2,960	ADTN	78	1,230	11.82%	17%	298,537	13%	11%	1985
92	90	FileNet	347	12%	14%		20	-98%	6%	4%	1,280	FILE	103	1,700	2.04%	13%	204,188	16%	16%	1982
93	86	PictureTel	323	-20%	5%		(85)				484	PCTL	61	1,225	-16.44%	6%	263,901	16%	20%	1984
94		Inter-Tel	314	14%			27	201%	9%		1,170	INTL								
95		Cognos	301	23%	22%	49%	58	79%	19%	81%	2,680	COGN	150	1,664	23.81%	12%	180,965	14%	14%	1969
96		Network Appliance	289	74%	165%	31%	36	70%	12%		30,450	NTAP	227	816	81.33%		354,681	10%	11%	1992
97		BEA Systems	289	74%		40%	(52)				20,430	BEAS	236	1,200	50.00%		240,868	18%	15%	1995
98	99	MRV Communications	289	9%	75%	56%	(13)				4,610	MRVC	44	1,000	21.36%	66%	288,524	10%	12%	1988
99	106	Progress Software	286	19%	15%	61%	35	54%	12%	19%	921	PRGS	159	1,363	13.49%	7%	209,905	13%	13%	1981
100		Nextlink	274	96%			(559)				14,464	NXLK	1,882							1994
101	91	Network Equipment Techs.	264	-15%	2%	70%	(7)			2%	228	NWK	32	1,237	-12.14%	2%	213,286	14%	17%	1983
102	102	Hypercom	262	2%	23%	46%	9	-34%	4%		585	HYC	37	1,166			224,284	9%	12%	1978
103		Epicor Software	258	307%	36%	27%	(49)				364	EPIC	30	1,550	148.40%	19%	166,581	18%	12%	1984
104		Corel	243	-1%	8%	36%	17		7%	-12%	934	CORL	18	1,400	10.67%	30%	173,643	31%	34%	1985
105		Exodus Communications	242	359%			(130)				26,930	EXDS	1,016	1,200	154.24%		201,783	7%	4%	1994
106	89	Digital Microwave	236	-31%	15%	87%	(97)				2,660	DMIC	27	873	-23.89%	10%	270,904	7%	10%	1984
107	121	Remedy	229	45%	63%	34%	30	56%	13%	57%	1,960	RMDY	172	977	27.88%	50%	234,322	21%	18%	1990
108	116	The Santa Cruz Operation	224	30%	4%	57%	17		8%	3%	662	SCOC	63	1,209	6.43%		184,966	24%	18%	1979
109	93	Exabyte	223	-22%	-10%	34%	(50)				182	EXBT	33	1,075	-11.30%	-3%	207,281	10%	16%	1985
110		Network Solutions	221	136%	113%		27	139%	12%		11,890	NSOL	309	800	107.79%		276,013	5%	5%	1979
111	127	Check Point Software	220	55%	208%	28%	96	37%	44%	425%	17,162	CHKP	243					7%	9%	1993
112		RSA Security	218	27%	65%	30%	184	525%	84%	140%	2,770	RSAS	697	875	14.53%	56%	249,286	18%	17%	1984
113		MTI Technology	202	1%	10%	33%	10	-44%	5%	28%	1,620	MTIC	7	580	3.20%	-2%	347,671	6%	6%	1978
114		Polycom	200	71%	68%	31%	29	88%	15%		4,270	PLCM	61	362	48.97%	48%	552,671	13%	11%	1990
115	112	Digi International	194	6%	8%	15%	3		2%	-28%	159	DGI	21	600	-14.65%	7%	322,500	9%	13%	1985
116	129	Prodigy Communications	189	39%			(80)				1,350	PRGY	35	394			479,792	8%	7%	1984
117		Mercury Interactive	188	55%	52%	34%	33	70%	18%	46%	10,140	MERQ	171	857	38.00%	32%	219,020	14%	13%	1989
118		Printronix	180	5%	11%	51%	12	-18%	7%	45%	116	PTNX	12	942	2.17%	1%	190,766	9%	10%	1974
119		Remec	179	-6%	31%	13%	(5)	-133%			996	REMC	83	1,904	0.95%	23%	94,126	4%	6%	1983
120	111	Inprise/Borland	175	-7%	-15%		23	172%	13%		568	INPR	198					25%	24%	1983
121	110	General DataComm	171	-12%	-4%	48%	(23)				356	GDC	4	1,118	-20.88%	-9%	152,952	16%	16%	1969
122		Ardent Software	169	42%	30%		9	425%	5%	18%	1,220	ARDT	43					15%	12%	1984
123	123	Standard Microsystems	156	5%	-14%	83%	(13)				213	SMSC	70	538	11.85%	-6%	289,639	10%	11%	1971
124		Harbinger	156	15%	63%	17%	19		12%		1,350	HRBC	73	1,038	6.46%	40%	149,821	8%	8%	1983
125	130	Computer Network Tech.	152	14%	14%	32%	5	-2%	3%		581	CMNT	16	707	17.64%	16%	214,559	16%	16%	1983
126	113	VTEL	152	-16%	23%	10%	(16)				197	VTEL	12	617	-16.62%	18%	245,708	11%	12%	1985
127		Comdial	148	15%	14%		8	-54%	5%	20%	175	CMDL	2	898	-2.29%	2%	164,766	6%	7%	1982
128	144	Concentric Network	147	78%	226%		(85)				2,200	CNCX	106	877	54.13%	96%	167,685	9%	7%	1991
129	142	Brooktrout	141	40%	43%	23%	19	5652%	14%	50%	501	BRKT	50	397	-4.57%	42%	354,521	22%	20%	1984
130	126	Datapoint	138	-9%	-4%	80%	(8)				23	DTPT	4					2%	1%	1976
131	158	Peregrine Systems	138	123%	54%	36%	(23)				6,932	PRGN	24	1,100	223.53%		125,545	4%	3%	1981
132		InterVoice-Brite	137	34%	18%	18%	20		15%	12%	1,080	INTV	12	722	9.06%	7%	189,618	12%	10%	1983
133		Foundry Networks	134	684%		20%	23	-345%	17%		23,780	FDRY	160	247	88.55%		540,575	52%	7%	1996
134	157	RealNetworks	131	98%		21%	7		5%		10,440	RNWK	345	650	49.77%		201,911	34%	29%	1994

Fiscal year ends	Web address	Chair	CEO	President	Products and services	Subsidiary and other notes
Sep	sterling	Sam Wyly	Sterling Williams	Sterling Williams	Business software	
Sep	andrew	Floyd English	Floyd English	Guy Campbell	Communications equipment and systems	Andrew SciComm
Dec	siebel	Thomas Siebel	Thomas Siebel	Paul Wahl	Sales automation and customer service software	
Dec	commscope	Frank Drendel	Frank Drendel	Brian Garrett	Coaxial and fiber-optic cable	Alcatel Electronics Cable
Dec	veritas	Mark Leslie	Mark Leslie	Mark Leslie	Storage management software	
Jan	comverse	Kobi Alexander	Kobi Alexander	Kobi Alexander	Enhanced telecommunications systems	StarTel
Mar	adaptec	Laurence Boucher	Robert Stephens	Robert Stephens	Data transfer hardware and software	
Dec	networkassociates	William Larson	William Larson	William Larson	Security software	McAfee.com
Dec	earthlink.net	Charles Betty	Charles Betty	Michael McQuary	ISP	
Sep	sterlingcommerce	Sterling Williams	Warner Blow	J. Brad Sharp	E-commerce software, network support	
Jun	analysts	Frederick Lang	Frederick Lang	Michael LaVelle	IT consulting programming and software	
Mar	symantec	John Thompson	John Thompson	John Thompson	Software for individual and network computers	
Dec	psi.net	William Schrader	William Schrader	Harold Williams	ISP	Transaction Network Services
Dec	level3	Walter Scott	James Crowe	James Crowe	Local, long-distance and Internet services	Commonwealth Telephone Enterprises
Dec	aspect	James Carreker	James Carreker		Equipment and software for customer service	
Apr	norstan	Paul Baszucki	David Richard	David Richard	Call centers, integrated digital networks	Connect Computer
Dec	icgcomm	J. Shelby Bryan	J. Shelby Bryan	John Kane	Telecommunications services	Fiber Optic Technologies Of The Northwest
Dec	premtec	Boland Jones	Boland Jones	Jeffrey Alfred	Message management services	Voice-Tel Enterprises
Dec	winstar	William Rouhana	William Rouhana	Nathan Kantor	Local telecom and private transmission services	
Dec	home.net	Thomas Jermoluk	Thomas Jermoluk	George Bell	ISP	
Sep	xircom	Dirk Gates	Dirk Gates	Dirk Gates	PC and LAN adapters	
Dec	citrix	Edward Iacobucci	Mark Templeton	Mark Templeton	Windows networking software	
Mar	telxon	John Paxton	John Paxton	John Paxton	Software and peripherals for mobile computing	Aironet Wireless, Metanetics, Virtual Vision
Dec	adtran	Mark Smith	Mark Smith	Howard Thraikill	High-speed transmission products	
Dec	filenet	Theodore Smith	Lee Roberts	Lee Roberts	Document management software and optical storage	
Dec	picturetel	Norman Gaut	Norman Gaut	Norman Gaut	Videoconferencing systems	MultiLink
Dec	inter-tel	Steven Mihaylo	Steven Mihaylo	Steven Mihaylo	Telecommunications equipment	
Feb	cognos	James Tory	Renato Zambonini	Renato Zambonini	Application development tools	
Apr	netapp	Don Valentine	Daniel Warmenhoven	Daniel Warmenhoven	Data storage devices for Internet companies	
Jan	beasys	William Coleman	William Coleman	Alfred Chuang	Software for networking and Web computing	
Dec	mrv	Shlomo Margalit	Noam Lotan	Noam Lotan	Network switches	Nbase Communications
Nov	progress	Joseph Alsop			Software developers' tools	
Dec	nextlink	Daniel Akerson	Daniel Akerson		CLEC that provides fiber for local and long distance	
Mar	net	Hans Wolf	Hubert Whyte	Hubert Whyte	WAN hardware and software	
Jun	hypercom	Albert Irato	Albert Irato	Albert Irato	Credit card equipment	
Dec	epicor	George Klaus	George Klaus	George Klaus	Enterprise resource planning software	
Nov	corel	Michael Cowpland	Michael Cowpland	Michael Cowpland	Multimedia production, graphics and publishing software	
Dec	exodus.net	K. Chandrasekhar	Ellen Hancock	Ellen Hancock	Internet and intranet services and software	
Mar	dmcwave	Charles Kissner	Charles Kissner	Sam Smookler	Digital microwave for wireless communication companies	MAS Technology
Dec	remedy	Lawrence Garlick	Lawrence Garlick		Desk software for corporate networks	
Sep	sco	Alok Mohan	Douglas Michels	Douglas Michels	Enterprise resource planning applications	Pandesic
Dec	exabyte	William Marriner	William Marriner	Wiliam Marriner	Tape-based data storage	
Dec	netsol	Michael Daniels	James Rutt		Network engineering and security services	Bought by VeriSign in 2000
Dec	checkpoint	Gil Schwed	Gil Schwed	Gil Schwed	Network security products	
Dec	rsasecurity	Charles Stuckey	Charles Stuckey	Arthur Coviello	Security hardware and software for networks	
Mar	mti	Raymond Noorda	Thomas Raimondi	Thomas Raimondi	High-performance data storage	
Dec	polycom	Brian Hinman	Robert Hagerty	Robert Hagerty	Video-, audio- and data-conferencing equipment	
Sep	dgii	John Schinas	Joseph Dunsmore	Joseph Dunsmore	Connectivity hardware and software	
Dec	prodigy	Samer Salameh	Samer Salameh	David Trachtenberg	ISP	
Dec	merc-int	Amnon Landan	Amnon Landan	Amnon Landan	Software that eliminates net bugs and viruses	
Mar	printronix		Robert Kleist	Robert Kleist	High-speed industrial printers	
Jan	remec	Ronald Ragland	Ronald Ragland	Errol Ekaireb	Microwave transmission systems	Humphrey
Dec	inprise		Dale Fuller	Dale Fuller	Programming languages, application development tools	Merged with Borland in 2000
Sep	gdc	Charles Johnson	Charles Johnson	Ross Belson	ATM switches and multiplexers	
Dec	ardentsoftware	Peter Gyenes	Peter Gyenes	Peter Gyenes	Data warehousing software	Part of Informix-March 2000
Feb	smsc	Paul Richman	Steven Bilodeau	Steven Bilodeau	PC input/output integrated circuits	
Dec	harbinger	C. Tycho Howle	C. Tycho Howle	James Travers	Services and software for Web-based businesses	
Dec	cnt	Thomas Hudson	Thomas Hudson	Thomas Hudson	Networking and communication devices	
Jul	vtel	F. H. Moeller		Stephen Von Rump	Videoconferencing systems	
Dec	comdial	William Mustain	William Mustain	William Mustain	Computer-telephony integration software	
Dec	concentric	Henry Nothhaft	Henry Nothhaft	Henry Nothhaft	ISP	
Dec	brooktroutinc			Eric Giler	Hardware and software for communication processing	Interspeed
Jul	datapoint	Asher Edelman	Asher Edelman		Computer-based solution services	
Mar	peregrine	John Moores	Stephen Gardner	Stephen Gardner	E-infrastructure solutions	
Feb	intervoice	Daniel Hammond	Daniel Hammond	David Berger	Call automation systems	
Dec	foundrynet	Bobby Johnson	Bobby Johnson	Bobby Johnson	High-performance LAN and WAN switches	
Dec	realnetworks	Robert Glaser	Robert Glaser		Video and audio players for the Internet	

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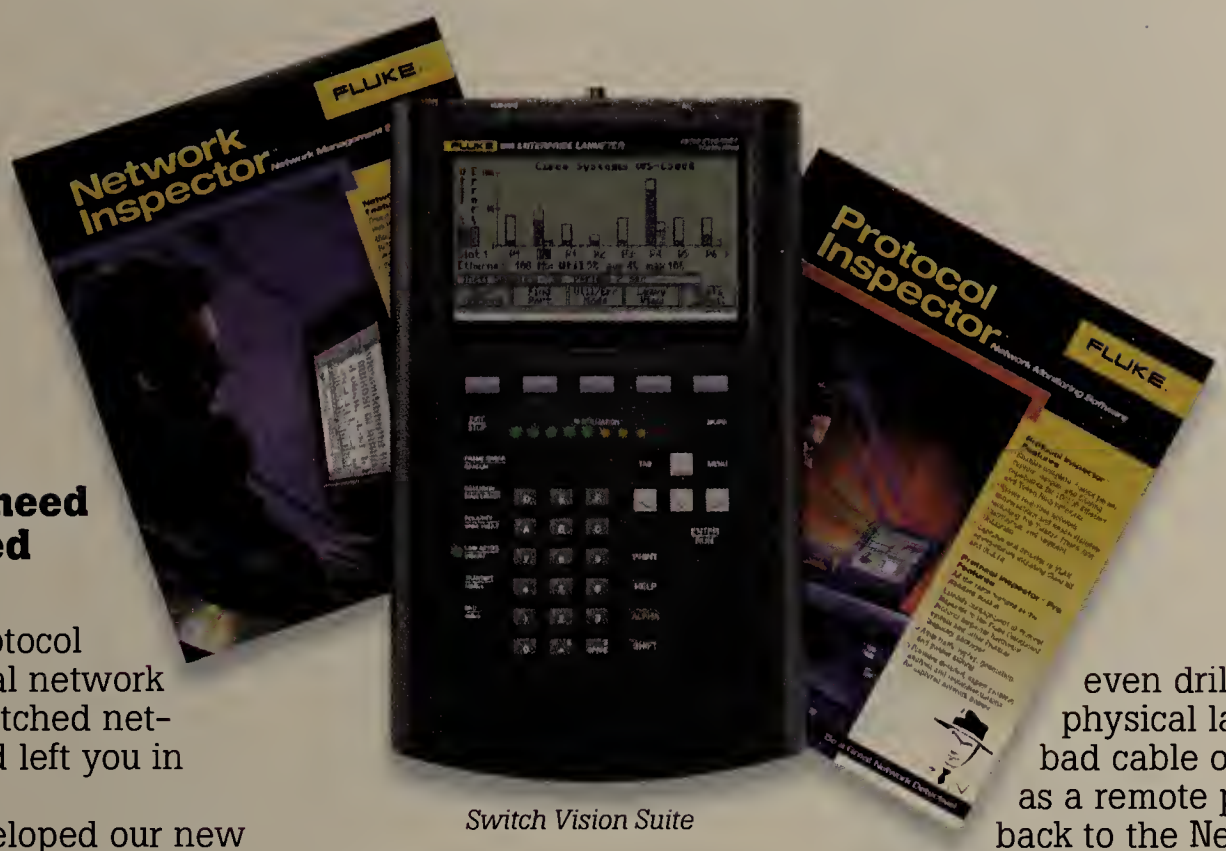
FLUKE



Switch Vision Suite

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A few years ago, a protocol analyzer gave you total network visibility. But then switched networks came along and left you in the dark.

That's why we developed our new Switch Vision Suite. It's a powerful package of visionary network management products that work together to monitor, analyze and troubleshoot to give you control of every situation that pops up. You get enterprise-wide vision with the power to drill down seven layers deep. All for about the same price as the leading protocol analyzer.

For starters, our Network Inspector™ software monitors and trends all the ports in your switched network. Our new Trace SwitchRoute™ feature pinpoints problems between nodes.

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Then, put our LANMeter® with SwitchWizard™ to work. It's the fastest way to find problems in switched networks. In seconds, it can zero in on the problem and give you detailed error information – from anywhere in the network. You can even drill down to the physical layer to isolate a bad cable or a NIC. Or use it as a remote probe to feed data back to the Network Inspector console.

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Rank			1999 revenue				1999 profit/loss				Mkt. cap.		Cash and invest	Number of employees			Rev. per employee	R&D		
1999	1998	Company	$M	'98-'99 % Δ	'94-'99 CAGR	Int'l %	$M	'98-'99 % Δ	% of rev.	'94-'99 CAGR	$M 3/3/00	Stock symbol	$M	1999	'98-'99 % Δ	'94-'99 CAGR	1999	% rev. 1998	% rev. 1999	Year Inc.
135	145	AVT	130	26%	35%	18%	18	27%	14%	34%	944	AVTC	74	430	33.13%	34%	$302,847	9%	8%	1982
136	133	Documentum	128	3%	65%	34%	(8)			35%	1,230	DCTM	83	660	7.14%	34%	$193,885	15%	20%	1990
137		SCM Microsystems	127	50%		52%	9		7%		1,740	SCMM	125	377	28.67%		$337,666	8%	7%	1996
138		New Era of Networks	126	92%	317%		(46)				2,700	NEON	57	601	163.60%		$210,023	24%	28%	1994
139		Dot Hill Systems	124	-26%		14%	9	1441%	7%		346	HIL	48	350	116.05%		$354,857	21%	19%	1997
140		Datalink	119	35%	30%		7	4%	6%	30%	178	DTLK	7	135	3.85%	30%	$880,719	2%	2%	1963
141		Beyond.com	117	220%			(88)				190	BYND	66	300	118.98%	44%	$391,000	11%	9%	1994
142	180	ISS Group	116	104%		18%	7		6%		4,580	ISSX	139	825	151.52%		$141,196	17%	17%	1994
143	172	BroadVision	116	127%	192%	30%	19	366%	16%		21,030	BVSN	300	687	153.51%	118%	$168,143	18%	13%	1993
144	118	Auspex Systems	113	-33%	6%	33%	(39)				313	ASPX	43	615	0.49%	14%	$184,512	20%	31%	1987
145	141	Axent Technologies	113	12%	66%	30%	1	-95%	1%		807	AXNT	109	637	59.25%	51%	$177,100	19%	24%	1991
146	138	Network Computing Devices	109	3%	-7%	40%	(16)			9%	122	NCDI	9	339	-0.29%	-4%	$321,622	13%	12%	1988
147	148	Apex PC Solutions	107	42%	71%	36%	21	35%	20%	70%	890	APEX	16	90	9.76%	25%	$1,192,089	4%	6%	1985
148	136	Procom Technology	101	-9%	24%	33%	(3)			29%	440	PRCM	249	306	-0.65%	19%	$331,013	4%	5%	1987
149		Extreme Networks	98	316%		53%	(2)				6,270	EXTR	107	249	56.60%		$393,679	45%	17%	1996
150		Tibco	96	83%			(7)				22,110	TIBX	90	490	60.13%		$196,735	28%	29%	1997
151		Aspect Development	95	10%	62%	12%	8	-51%	8%		4,800	ASDV	76	800	21.40%		$118,801	18%	21%	1990
152		Osicom Technologies	95	-20%		26%	(13)				1,480	FIBR	5	1,318	-21.41%		$72,040	6%	10%	1981
153		eShare Technologies	95	-2%	28%	31%	(10)				299	ESHR	15	472	5.36%		$200,964	12%	15%	1996
154		Open Text	93	104%	125%	54%	20		22%		1,280	OTEX	140	700	75.00%		$132,143	17%	12%	1991
155	143	Davox	92	4%	25%	13%	12	41%	13%		492	DAVX	65	444	11.56%	24%	$208,108	3%	4%	1981
156		Visual Networks	92	64%			10		10%		1,740	VNWK	55	281	58.76%		$326,402	25%	18%	1994
157		Entrust Technologies	85	74%	85%	15%	6		7%	127%	5,110	ENTU	89	545	19.52%	75%	$156,356	26%	19%	1994
158		VeriSign	85	118%		27%	4		5%		25,470	VRSN	156	394	25.08%		$215,168	22%	16%	1995
159	147	Centigram Communications	83	7%	1%	-12%	0			-45%	128	CGRM	45	326	0.31%		$255,592	23%	19%	1980
160	159	Open Market	83	29%		32%	(20)				2,570	OMKT	32	460	15.58%		$180,491	40%	27%	1994
161	152	NetManage	79	10%	5%		(27)				496	NETM	136	800	75.82%	18%	$99,000	26%	23%	1990
162		JetForm	78	3%	67%	30%	(20)				230	FORM	57	664	9.75%	37%	$118,185	9%	13%	1982
163	163	Mobius Mgmt. Systems	74	31%	33%	13%	4	-6%	6%	40%	108	MOBI	34	438	30.75%		$168,575	14%	14%	1981
164	156	Interphase	74	7%	13%	17%	3	26%	5%		136	INPH	16	221	-3.49%	3%	$332,588	16%	14%	1974
165		Inktomi	71	249%			(24)				18,480	INKT	305	505			$140,990	66%	38%	1996
166		Quest Software	71	104%	66%		3	45%	5%	189%	4,830	QSFT	51	650	111.73%	113%	$109,028	23%	23%	1987
167	173	Proxim	69	39%	44%	21%	3	-34%	5%	35%	2,000	PROX	68	204		22%	$338,564	15%	13%	1984
168		Brocade Communications	69	183%			3		4%		16,980	BRCD	89	180	63.64%		$381,622	63%	22%	1995
169	162	Emulex	69	16%	2%	32%	5		8%		6,790	EMLX	22	132	-31.61%	-18%	$518,939	19%	17%	1979
170		BindView	68	77%	67%	10%	7		10%	70%	1,490	BVEW	66	440	48.65%	58%	$154,427	27%	25%	1990
171		NetScout Systems	68	58%	93%		10	91%	15%		545	NTCT	26	209	4.50%		$323,445			1984
172	176	Concord Communications	67	70%	75%	24%	13	47%	20%		601	CCRD	62	285	64.74%		$236,140	20%	17%	1991
173		Covad Communications	66	1148%		0%	(195)				9,079	COVD	639							1996
174	177	Verity	64	66%	31%	6%	12		19%		1,630	VRTY	36	295	18.00%		$218,390	40%	21%	1988
175	161	Zoom Telephonics	63	3%	-1%	30%	(1)				131	ZOOM	10	330	2.80%	9%	$192,236	7%	10%	1977
176		Active Voice	62	17%	17%	14%	(5)				312	ACVC	2	319	10.76%	19%	$195,038	18%	23%	1983
177	175	Cylink	60	40%	18%		(15)				591	CYLK						37%	27%	1984
178	169	Verilink	60	17%	10%		(14)				201	VRLK	18	200	-20.00%		$297,765	25%	22%	1982
179		Micromuse	58	105%		29%	8	841%	14%		6,210	MUSE	70	321	82.39%		$180,903	20%	16%	1998
180	150	ODS Networks	58	-22%	-8%	12%	(12)				484	ODSI	19	266	0.38%	-3%	$217,861	16%	20%	1983
181		Allaire	55	158%			(6)				2,210	ALLR	119	260	57.58%		$212,165	38%	23%	1996
182	165	ACT Networks	54	-1%	34%	51%	(3)				137	ANET	34	230	-4.96%	21%	$236,183	30%	24%	1987
183	151	Larscom	53	-27%	8%		(1)				177	LARS	29					16%	15%	
184	167	Centura Software	51	-5%	-2%	55%	(3)			-37%	578	CNTR	21	285	39.71%	-7%	$178,947	16%	18%	1987
185		Vodavi Technology	50	3%	11%		1	26%	2%	2%	26	VTEK	2					3%	3%	1983
186		Syntellect	48		1%	18%	(2)				63	SYNL	7	251	-84.12%	2%	$190,562	12%	9%	1984
187		Interliant	47	861%			(54)				1,873	INIT	31							1997
188		Segue Software	46	14%	49%		(16)				130	SEGU	21	330	11.86%		$140,606		22%	
189	149	Banyan	46	64%	-21%	49%	28	2418%	61%	41%	455	BNYN	131	345	-19.39%	-17%	$132,748	7%	4%	1983
190	174	FVC.com	46	23%			(14)			41%	376	FVCX	1,005	125	25.00%		$365,600	25%	22%	1997
191	182	Performance Technologies	44	31%	29%		6	3%	13%	64%	355	PTIX	10	140		6%	$317,814	15%	18%	1983
192	187	Netopia	44	78%	-5%	28%	(8)				1,360	NTPA	69	271	44.15%	6%	$162,919	29%	21%	1985
193		Perle Systems	43	43%	13%	50%	1	-60%	1%	-15%	70	PERL	1	263	42.16%	8%	$163,219	12%	12%	1976
194		Microtest	43	3%	2%	31%	(1)				110	MTST	10	200	-8.68%	5%	$214,000	19%	17%	1984
195		SpectraLink	41	17%	38%		8	282%	19%		470	SLNK	21	293	10.57%		$140,509	11%	10%	1992
196		Nstor Technologies	41	128%			(20)				124	NSO		200	669.23%		$205,445			1996
197		ECCS	40	40%	-1%		2		5%		199	ECCS	8	125		1%	$318,088	9%	5%	
198		Vixel	39	-1%	87%	21%	(22)		-58%		656	VIXL	61	187	12.65%		$207,631	28%	33%	1991
199		Applied Theory	38	67%			(14)		-37%		763	ATHY	48	412	116.84%		$91,371	1%	1%	1999
200		Asante	37	-27%	-14%	24%	(14)		-38%		22	ASNT	5	84	-35.38%	-13%	$446,286	13%	10%	1988

Fiscal year ends	Web address	Chair	CEO	President	Products and services	Subsidiary and other notes
Dec	appliedvoice	Richard LaPorte	Richard LaPorte	Richard LaPorte	Voice messaging and call center technology	RightFAX
Dec	documentum	Robert Adams	Jeffrey Miller	Jeffrey Miller	Document management software	
Dec	scmmicro	Robert Schneider	Steven Humphreys	Steven Humphreys	Data security and access control	
Dec	neonsoft	George Adam	George Adam	Pat Fortune	Proprietary software for large institutions	
Dec	dothill	W. Sauey			Data storage	
Dec	datalink	Robert Price	Greg Meland	Greg Meland	High-end data storage systems	
Dec	beyond	William McKiernan			Online software retailer	
Dec	iss	Thomas Noonan	Thomas Noonan	Thomas Noonan	Network security software	Internet Security Systems
Dec	broadvision	Pehong Chen	Pehong Chen	Pehong Chen	Business Web site designers	
Jun	auspex	Bruce Moore	Bruce Moore	Bruce Moore	High-performance servers	Alphatronix
Dec	axent	John Becker	John Becker	Brett Jackson	Network security software	Secure Network Consulting
Dec	ncd	Robert Gilbertson	Rudolph Morin	Rudolph Morin	Thin-client computers	
Dec	apexpc		Kevin Hafer	Kevin Hafer	Switching systems for networks	
Jul	procom	Alex Razmjoo	Alex Razmjoo	Alex Razmjoo	CD-ROM and RAID storage products	
Jun	extremenetworks	Gordon Stitt	Gordon Stitt	Gordon Stitt	Networking and communication devices	
Nov	tibco	Vivek Ranadive	Vivek Ranadive	Vivek Ranadive	Messaging technology	
Dec	aspectdv	Romesh Wadhwani	Romesh Wadhwani	Robert Evans	Supply chain software	
Jan	osicom	Par Chadha	Par Chadha	Xin Cheng	Dense-wave division multiplexing	NETsilicon
Dec	eshare	Aleksander Szlam	Aleksander Szlam	James Tito	Call management systems	
Jun	opentext		P. Thomas Jenkins	John Shackleton	Intranet software	
Dec	davox	Alphonse Lucchese	Alphonse Lucchese		Call center systems	
Dec	visualnetworks	Scott Stouffer	Scott Stouffer	Scott Stouffer	Management software	
Dec	entrust	F. William Conner	John Ryan	John Ryan	Security software	
Dec	verisign	D. James Bidzos	Stratton Scalvos	Stratton Scalvos	Digital IDs and digital certification	Network Solutions
Oct	centigram	Dean Morton	Robert Puette	Robert Puette	Unified messaging systems	
Dec	openmarket	Shikhar Ghosh	Gary Eichhorn	Ron Matros	Electronic commerce software	
Dec	netmanage	Zvi Alon	Zvi Alon	Zvi Alon	PC connectivity software	Wall Data and Simware
Apr	jetform	Abraham Ostrovsky	John Kelly	John Kelly	Electronic forms	
Jun	mobius-inc	Mitchell Gross	Mitchell Gross	Mitchell Gross	Data management software	
Dec	iphase	Stephen Polley	Gregory Kalush	Gregory Kalush	Network and mass storage products	
Sept	inktomi	David Peterschmidt	David Peterschmidt	David Peterschmidt	Customized Web search engines	
Dec	quest	Vincent Smith	Vincent Smith	David Doyle	Database management systems software	
Dec	proxim	David King	David King	David King	Communication equipment for portable devices	
Oct	brocade		Gregory Reyes	Gregory Reyes	Networking and communication devices	
Jun	emulex	Fred Cox	Paul Folino	Paul Folino	Network connectivity	
Dec	bindview	Eric Pulaski	Richard Gardner	Richard Gardner	Security management and security software	
Mar	netscout	Anil Singhal	Anil Singhal	Anil Singhal	Application tracking software for networks	
Dec	concord		John Blaeser	John Blaeser	Global network problem monitoring	
Dec	covad	Charles McMinn	Robert Knowling	Robert Knowling	DSL services	
May	verity	Gary Sbona	Gary Sbona	Anthony Bettencourt	Retrieval software	
Dec	zoomtel	Frank Manning	Frank Manning	Frank Manning	Modems, fax modems and remote access servers	
Mar	activevoice	Robert Richmond	Frank Costa	Frank Costa	Communications software, interactive voice response	Pronexus
Dec	cylink	Leo Guthart	William Crowell	William Crowell	Security software	
Jun	verilink	Howard Oringer	Graham Pattison	Graham Pattison	Internet access systems	
Sep	micromuse	Gregory Brown	Gregory Brown	Stephen Allott	Information management software	
Dec	ods	G. Ward Paxton	G. Ward Paxton	G. Ward Paxton	Network hubs, switching equipment	
Dec	Allaire	Joseph Allaire	David Orfao	David Orfao	Electronic business platforms	Valto Systems
Jun	acti	Andre de Fusco	Andre de Fusco	Andre de Fusco	Customized network access systems	
Dec	larscom	Lawrence Milligan	Robert Coackley	Robert Coackley	High-speed internetworking components and software	
Dec	centurasoft	Scott Broomfield	Scott Broomfield	Scott Broomfield	Database storage software	
Dec	vodavi	William Hinz	Gregory Roeper	Gregory Roeper	Telephone systems, interactive voice response (IVR)	
Dec	syntellect	Anthony Carollo	Anthony Carollo	W. Scott Coleman	IVR systems, interactive Web response	
Dec	interliant	Fasser Field	Herb Hribar	James Lidestri	Application services provider	Formerly Sage Networks
Dec	segue	Jesse Simons	Stephen Butler	Stephen Butler	Online transaction software	
Dec	banyan	William Ferry	William Ferry	William Ferry	Internet services business support	Switchboard
Dec	fvc	Ralph Ungermann	Richard Beyer	Richard Beyer	Interactive video networking products	
Dec	pt	Donald Turrel	Donald Turrell	Donald Turrell	Network and communications hardware	UCONx
Sep	netopia	Reese Jones	Alan Lefkof	Alan Lefkof	Real-time connectivity software for networks	
May	perle		Joseph Perle	Joseph Perle	Dial-in hardware for networks	
Dec	microtest	Kent Mueller	Vincent Hren	Vincent Hren	Network management and connectivity tools	
Dec	spectralink		Bruce Holland	Bruce Holland	Wireless on-site telephone systems	
Dec	nstor	H. Irwin Levy	Lawrence Steffann	Lawrence Steffann	RAID storage subsystems	
Dec	eccs	Michael Faherty	Gregg Azcuy	Gregg Azcuy	Computer peripherals	
Dec	vixel	James McCluney	James McCluney	James McCluney	Interconnection products for SANs	
Dec	appliedtheory	Richard Mandelbaum	Richard Mandelbaum	Lawrence Helft	ISP	
Sep	asante		Wilson Wong	Wilson Wong	Hardware and software for connecting workgroups	

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*Network Computing, January 24 2000.

Is your vendor healthy?

TIPS FOR GIVING YOUR VENDOR A FINANCIAL CHECKUP.

By Neal Weinberg

Evaluating the financial health of key vendors is a lot like troubleshooting your network. But instead of wading through a blizzard of reports generated by network management tools, you need to decipher the hidden meaning in reports written by financial sorts.

While vendors can say pretty much whatever they want in marketing brochures and sales pitches, they face severe penalties if they play fast and loose with the facts in Securities and Exchange Commission filings. In other words, the information contained in annual reports, quarterly earnings statements and other public documents filed with the SEC is as close to the truth as you're going to get.

Thanks to the Internet, these documents are at your fingertips, readily available from most vendors and at www.sec.gov. At the latter site, you'll find EDGAR, a searchable database of documents filed by public companies with the SEC.

Quarterly earnings and annual reports are filed on 10-K forms, so those are your first stop. Don't be put off. The consolidated balance sheet on a 10-K may contain page after page of mind-numbing figures, but you just need to zero in on two lines — revenue and net income.

Revenue is money coming in from any and all sources. This includes the ongoing revenue stream from the sale of goods and services and one-time gains from the sale of buildings, equipment, product lines, business units, patents or technologies.

Net income, also referred to as profits or earnings, is what's left over from revenue after subtracting the cost of doing business or the cost of sales. Costs include research and development, production, and the cost of sales, general business expenses and administrative costs. Of course, a vendor also can chalk up one-time costs if it buys the assets of another company.

ILLUSTRATIONS MARTIN MATJE

What you're hoping to see in a healthy company is a strong, sustained increase in revenue and earnings, when all the one-time charges are subtracted. With a start-up, you're looking for signs that revenue is increasing and that the company has enough money to stay afloat until it begins turning a profit (see story, next page).

If an established vendor reports an increase in profits but declining or stagnating revenue, that could signal trouble. It's possible the company is covering up for slow revenue by cutting enough on the cost side to continue showing a healthy profit. But if revenue isn't keeping pace with the rest of the industry, that could mean products are late to market or those wares aren't getting a favorable reception among customers, for example.

If revenue remains sluggish over several quarters, the company may be forced into deeper cuts. Those cuts could affect the service you receive or hamper development on product lines you favor.

Let's take 3Com as our first patient. In the company's quarterly report released Dec. 21, 1999, sales were down 4% from the same period the prior year. Net income was $131 million, down from $133 million reported one year earlier. All in all, revenue and earnings were weak.

Of course, it's not a good idea to draw conclusions based on single quarter. For the first and second quarters of 3Com's fiscal year 2000, which began May 29, 1999, sales were down from $2.9 billion to $2.8 billion. How about the past three years? Sales went from $5.6 billion in 1997 to $5.4 billion in 1998, edging up to $5.8 billion in 1999. That's nothing to write home about, especially since 3Com's Palm division, since spun out, had been going gangbusters and the national economy was on a roll, in large part buoyed by the fast-growing networking segment. By contrast, Cisco grew from $6.4 billion in 1997 to $8.5 billion in 1998, and to $12.1 billion in 1999.

So if you were the doctor examining 3Com, you'd be ordering some extra diagnostic tests.

The Wall Street angle

Checking revenue and profits is a good first step, but a thorough exam requires drilling down into other metrics. Your next stop: Wall Street, to look at stock performance. Stock price is a key

barometer of a company's health because the stock market sets a value on a company based on a six- to nine-month performance projection.

So if your vendor's stock is on a sustained downward slide, find out why. With the explosion of Internet-based stock trading companies, as well as the proliferation of online business news, it's relatively easy to obtain good financial information.

Analysts have their biases, so find one you have confidence in.

Also understand that your interests and the goals of the financial community are not the same. You want your vendor to stay the course, to continue developing and supporting product lines. Wall Street doesn't care about that. If severe cost cutting, which could mean discontinuing a product line, would boost profits, Wall Street would be all for it. And if selling the company altogether would result in a big stock gain, then Wall Street would love that, too.

Which brings us back to stock price. Simple math tells you that if a stock drops by half, then purchase price just dropped by the same margin. So a decline in a company's stock price is directly proportional to its vulnerability to a takeover.

Cabletron's stock hit a high of $46.50 a share in the first quarter of 1998, but dropped to $12.63 by the end of that year. That's a warning sign.

After you've checked out revenue and profits and have analyzed stock performance, it's time to dive into the guts of the annual report to look for trouble signs. What would these look like? Well, that's the hard part. Essentially, you're like a specialist with a new patient, looking for buried symptoms of disease. It's impossible to list all the categories here. But trouble signs can include too much inventory, litigation, declining profit margins, credit woes, cash flow shortages, unraveling relationships with resellers or customers or skyrocketing materials costs.

Here's a look inside Cabletron's 1998 annual report: First, revenue went down 2% and profits dropped from $222 million to $130 million. Were Cabletron's 1998 woes a one-time bump, or did they indicate a more serious problem? Proceeding through the 10-K, you find that sales of the company's core product — hubs — plummeted 57% and that "the company expects the decrease in sales of its shared media products to continue."

Under the heading "Business environment and risk factors," Cabletron frankly assesses its predicament. It states that competitors, including new enterprise data players like Nortel Networks and Lucent, are bringing products to market quickly by buying smaller data network companies that have hot technologies. Prices for these companies are extremely high, and Cabletron's deep-pocketed competitors are better able to afford them.

Bottom line: "In the past, Cabletron has relied on a combination of internal product development and partnerships to broaden its product line. Acquisitions in other data networking companies by Cabletron's competitors may limit Cabletron's access to commercially significant technologies and thus its ability to offer products that meet its customers' needs."

By the time Cabletron issued its 1999 annual report, its stock price during the fourth quarter had dropped to a low of $7.69 per share. The report noted that the company's product mix was shifting from high-margin hubs to low-margin switches. Not only that, Cabletron was moving from direct sales to a reseller model — in other words, it was adding middlemen and that was cutting into profits even more. Plus, Cabletron identified four new, well-heeled competitors on the horizon: Alcatel, Ericsson, Nokia and Siemens.

If you had been monitoring Cabletron's financial health, it would have come as no surprise that the company was in need of radical surgery — which is just what happened with its February dissection into four independent companies.

ON LINE

ANIMATED ANNUALS. Learn the ins and outs of a vendor's financial statement with our interactive primer.

DocFinder: 7823

A successful surgery, but the patient died

Also keep in mind that a company may choose a road to financial health that involves selling, discontinuing or de-emphasizing the product line you care most about.

On Feb. 17, Novell announced its results for first-quarter 2000. It may have been a coincidence, but on that same day, Bill Gates formally introduced Windows 2000 with Active Directory, a direct threat to Novell Directory Services (NDS).

Here's the way a stock analyst might look at the numbers. Novell reported an 11% increase in revenue, which is OK, but certainly not spectacular. Revenue from the NetWare line increased a paltry 6%, which isn't encouraging considering that the long delay of Windows 2000 was Novell's window of opportunity to grab market share.

And listen to what Novell CEO Eric Schmidt has to say about long-term plans: He's promising to transform Novell into an e-commerce company, with the goal of growing "revenue from 'Net services software products that rely on NDS eDirectory to support e-business." And what has Novell targeted as hot growth? Public-key security, cache management and personal identity control.

Notice anything missing? NetWare, perhaps? This isn't to say that Novell will do anything to alienate its NetWare customers, but if you're among that crowd, it's something to watch.

On to 3Com. For the second-quarter 2000, the company reported that sales of enterprise network products dropped 12%. In response, CEO Eric Benhamou identified five emerging high-growth markets to focus on: voice over IP; LAN telephony; wireless; broadband cable and digital subscriber line; and home networking. There's not an enterprise network product among the bunch.

As if that wasn't a bright enough red flag, in the 10-K's fine print, 3Com said it was late shipping the CoreBuilder 9000 eight-slot chassis, Gigabit Layer 3 modules and CoreBuilder 3.0 software. Anyone doing the reading had to wonder: 'Was 3Com committed to these products, or not?

The answer, as we know now, is not. On March 20, 3Com announced it was discontinuing its CoreBuilder Layer 2/3 Gigabit Ethernet and ATM LAN switches, and its PathBuilder and NetBuilder WAN switches and routers.

Some customers felt blindsided by the news, but it was all there in the financial reports. ◪

RED FLAGS

If one of your network vendors is associated with any of the following, trouble is afoot:

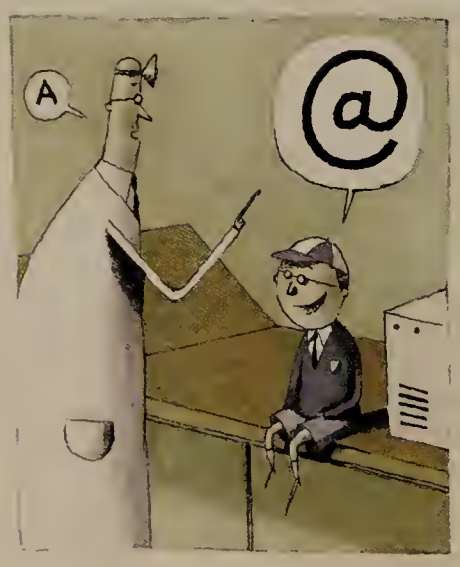
Restructuring.
A polite way of saying the company is shaking things up, big time, in response to poor earnings results.

Top management shake-up.
If you see top managers leaving, voluntarily or otherwise, you can be sure that something's up.

Poison pill.
If the company suddenly adopts a shareholder rights plan aimed at thwarting a takeover, that's a sign that wolves are knocking at the door.

Restatement of earnings.
Usually means somebody was cooking the books and got caught. Wall Street punishes a company for this type of transgression.

Strategic alternatives.
When a company brings in an investment bank to explore strategic alternatives, you're looking at a company that's hoping somebody will buy it, and



Start me up *Judging a newly public company's health is tricky.*

Minus historical measures, getting a handle on a start-up's financial well-being is extremely tough. All you can do is look at the earliest public documents to see if the company is on target.

For example, ITXC, a provider of Internet-based voice and fax services that went public in September 1999, announced recently that fourth-quarter 1999 revenue was up 10 times over the same period the prior year, from $1 million to $11 million. That's good. However, the net loss more than doubled, from $2.9 million to $6 million.

In the earnings statement, CEO Tom Evslin said he was pleased with the results. He noted that ITXC was able to sell international voice over the Internet service as fast as the company's network buildout would allow. And that buildout can continue because ITXC raised $78.4 million in its IPO.

Still, at this point, it's simply too early to draw any conclusions about ITXC's health. It takes time for a start-up to earn a profit.

In the case of Micromuse, which sells service-level management software, profitability took five years. Revenue has doubled every year since 1995, from $1.4 million to $4.5 million to $9.3 million to $28 million to $58 million. But profitability didn't come until 1999.

Wall Street has endorsed Micromuse. The company went public in February 1998 at $12 a share. The stock soared to an astounding $230 a share by the middle of February 2000.

— Neal Weinberg

The biggest threat to network security and performance isn't outside your firewall.

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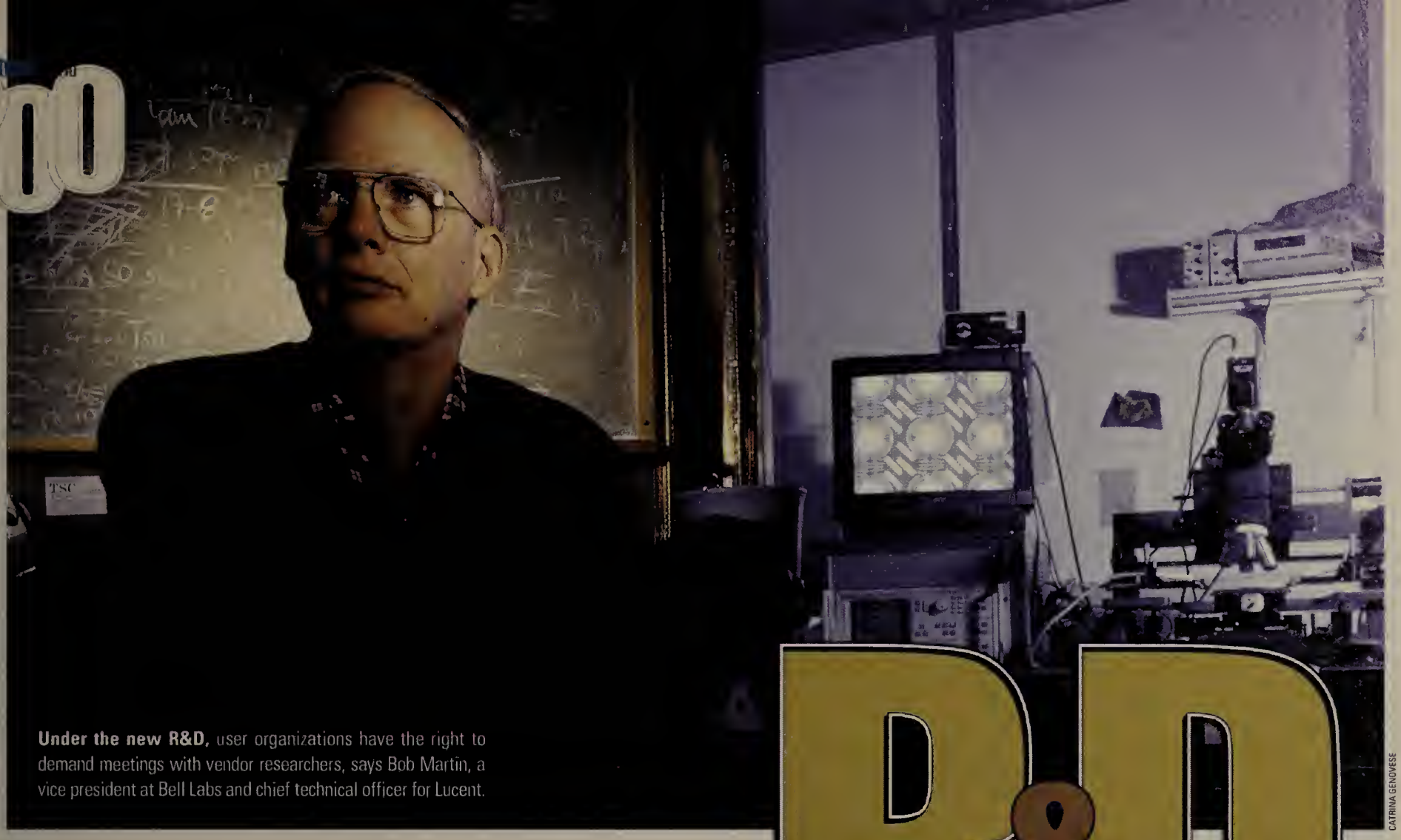


Under the new R&D, user organizations have the right to demand meetings with vendor researchers, says Bob Martin, a vice president at Bell Labs and chief technical officer for Lucent.

CATRINA GENOVESE

The new R&D

WHAT IT MEANS FOR YOU.

By Julie Bort

On a cool fall morning in 1998, researchers at Lucent's Bell Labs in scenic Murray Hill, N.J., meet with some customers. "Invent a device we can use to route signals through our optical networks without turning them into electricity first," the customers cry.

By February 1999, the team has a prototype. During a routine meeting with Lucent Optical Networking Group (ONG) executives, the team demonstrates the prototype, which they call an optical router. Jaws drop.

ONG puts the optical router on the fast track to production. While the researchers work on their invention, business executives fire up the marketing machine for a product name, marketing plan and prices. At the same time, ONG developmental engineers spec out manufacturing costs and equipment, even though the device itself is not completely defined.

By that June, the team demonstrates the device for the customers, Global Crossing and MCI WorldCom, only to be told that it needs more capacity. It has to be in their hands eight months ahead of Lucent's schedule.

The researchers slave in their lab to revamp the optical router to customers' demands while producing a reliable product that can be manufactured cost-effectively. On Nov. 9, ONG announces the device: the WaveStar LambdaRouter, a 10-terabit, all-optical router. The beta units ship in February; the production release is scheduled for July. From concept to product, less than 15 months elapse.

This is the new R&D — and what a whirlwind it's creating.

Once researchers could have studied an idea in their labs for five to 10 years before a business unit would take the technology and spawn marketable products from it. Today, networking vendors deliver products envisioned by customers, like the LambdaRouter, in less than two.

Never has the networking industry moved at such a clip and been so innovative. By all accounts, networking vendors have mastered the new business rules, with 1999 emerging as a breakthrough year for intellectual property.

Networking vendors earned more patents than companies in almost any other tech-heavy industry, including aerospace, automotive and pharmaceuticals, according to CHI Research, a Haddon Heights, N.J., consulting group. And data communications vendors earned more patents in 1999 than they did in each of the previous five years.

IBM placed first, with an amazing 2,736 patents awarded in 1999, compared with its five-year average of 1,800 patents per year, CHI found. Other industrious networking vendors were Lucent, with 1,137 patents in 1999 vs. a five-year average of 759 per year; Hewlett-Packard, with 850 patents vs. 565; and Sun, with 559 vs. 168.

The increase in patents is only one of the ways networking companies have buffed up their overall R&D health, CHI finds.

Most of the companies that make it on the Network World 200 list have mastered the craft of research and development. What's less obvious is that they've overhauled R&D in the process.

Whereas once a researcher's job was to make discoveries and publish papers, today success is measured by commercial gains. Under the new R&D, labs are required to solve business problems, not explore technology for its own sake. They must create ever more commercially successful technologies — a trick akin to picking No. 1 songs before a musician records them.

"This market is unpredictable. Yet the fundamental needs of the network are pretty clear, such as capacity. Who can get there quickest with the right

ON LINE

SHELLING OUT THE BUCKS. Which NW200 companies spent the most on R&D last year? Find out in our topic specific charts. You'll also see which companies made the most profit and which had the biggest drop in revenue.

DocFinder: 7824

functionality to satisfy the market will win," says Bob Martin, a Bell Labs vice president and chief technical officer for Lucent.

That's what Inktomi, the biggest R&D spender among NW200 companies, is counting on. It uses its R&D investment to fuel innovation in portal services, network products and wireless 'Net technology, says Richard Pierce, chief operating officer at the San Mateo, Calif., company. Inktomi spent $27 million, or 38% of 1999 revenue, on R&D.

Most important, for the first time at Lucent, Inktomi and elsewhere, users have become integral to the process. Researchers now work on customers' expressed business needs.

"No longer are most engineers locked in the closet with you throwing raw meat in at them. Of course, you'll still have a few of those. But more and more, they've begun to understand that we're expecting a business viewpoint," explains Richard Parvin, director of network infrastructure engineering for Sabre, in Fort Worth, Texas.

Look closer

With research booming, you may be lulled into thinking you don't need to spend time examining the long-term R&D health of any particular vendor. In fact, the reverse is true.

Turning ideas into products is the riskiest part of a vendor's business. The overall economic boom has boosted absolute numbers of technology innovations, says Charles Larson, president of Industrial Research Institute (IRI), a Washington, D.C., association of researchers. If the economy slows — as it surely will — only companies with sound R&D methods will continue to thrive.

More practically, if you don't examine R&D health, you could become the unwitting guinea pig for products that are not ready for prime time. Or you could be buying into products that a vendor may not support for the long haul, users say.

"When it comes to vendors of network equipment, servers and operating systems, a two- to three-year research focus is an important consideration for us," says Deke Kassabian, technical director of networking at the University of Pennsylvania in Philadelphia and a *Network World* Test Alliance Partner.

If a vendor's development resources are too lean, it could struggle to get new hardware designs finalized and into production or new software into beta, Kassabian has found. "Those might be early signs of underspending on R&D, which might be signs of a product line going stale," he says.

Even network executives who have no desire to be on the bleeding edge find it encouraging if a vendor has a good long-term research strategy. Such is the case for Russ Cherry, vice president of Internet technology at CDNOW, Inc. in Fort Washington, Pa. "I take 'relationship trips' to meet with various folks in research departments, to find out if there's synergy between where we're heading and where they are," Cherry says.

Determining R&D health is tricky. R&D budgets don't tell the whole story, warns Robert Buderi, author of *Engines of Tomorrow: How the World's Best Companies are Using their Research Labs to Win the Future*, due for publication soon.

"The difference between the 'R' and the 'D' is the difference between central research and research in business units," Buderi explains. "Typically, 90% of the R&D budget is development — turning an idea into a product, while 10% is research, looking for new ideas."

The R&D budget gets even more confused under the new R&D rules. Some companies, such as Nortel Networks and Cisco, don't have central research departments. At Nortel, all internal research is attached to a business unit, says David Mann, vice president of technology with the company's Emerging Business Technology Investments unit. Cisco, in turn, relies heavily on acquisitions and equity investment. For these vendors, determining exactly how much is being spent on long-term technology is nearly impossible from R&D figures published in annual reports.

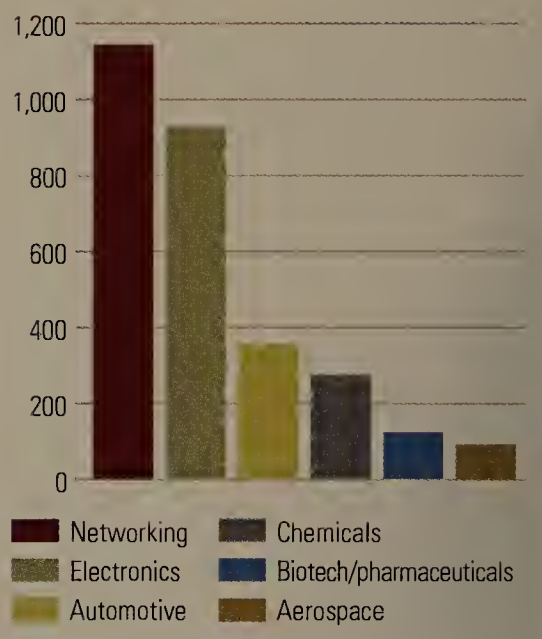
Vendors with central research labs now pass more research to the business units than ever

Continued on **page 90**

MASTERS OF THE NEW R&D

With revamped research and development methods, the networking industry leads other major U.S. technology industries in innovation.

Technological strength* (Mean average)



*Technological strength is measured by a number of factors, including the number and type (strong/weak) of patents filed.

SOURCE: CHI RESEARCH, HADDON HEIGHTS, N J

Where integration meets R&D

In the acquisition-heavy network industry, technology integration has become standard business fare for the R&D team.

Why has acquisition become such a cornerstone of innovation?

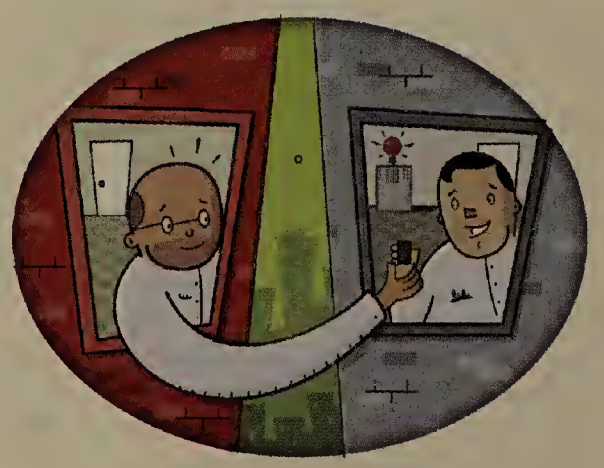
Two reasons, says Bob Martin, a vice president of Bell Labs and chief technical officer for Lucent in Murray Hill, N.J. "One is the speed at which the market is moving. The other is the availability of sophisticated technology building blocks."

These technology building blocks are items such as supersmart microchips that handle complex networking functions. "They have allowed venture capital to create little companies with quick time to market. Without these building blocks, such companies would have to have much larger development teams," Martin says.

As a result, research has moved from the hands of a few big labs into the hands of many.

"Someone today can raise $100 million in the capital markets or in an IPO. It's creating almost free capital for the research market. . . . We're not as dependent on two or three big labs," says Francis Narin, president of CHI Research, a Haddon Heights, N.J., research and development consultant.

The downside is that externally developed products



require researchers to have a much different skill set from the one needed for invention. They must become integrators.

"A member of ours has the title 'vice president of business growth,' not chief technology officer. He's a technology integrator, rather than a product producer," says Charles Larson, president of Industrial Research Institute, an association of researchers in Washington, D.C.

This has caused some finger-wagging within the research community. The argument, made by some old-line engineers, is that integration is a misuse of a researcher's talents, turning him into an assimilator rather than a creator. Breakthroughs may be sacrificed for short-term gain, they argue.

However, the data doesn't support this argument. Those involved in the new R&D say integration is every bit as challenging and important as innovation.

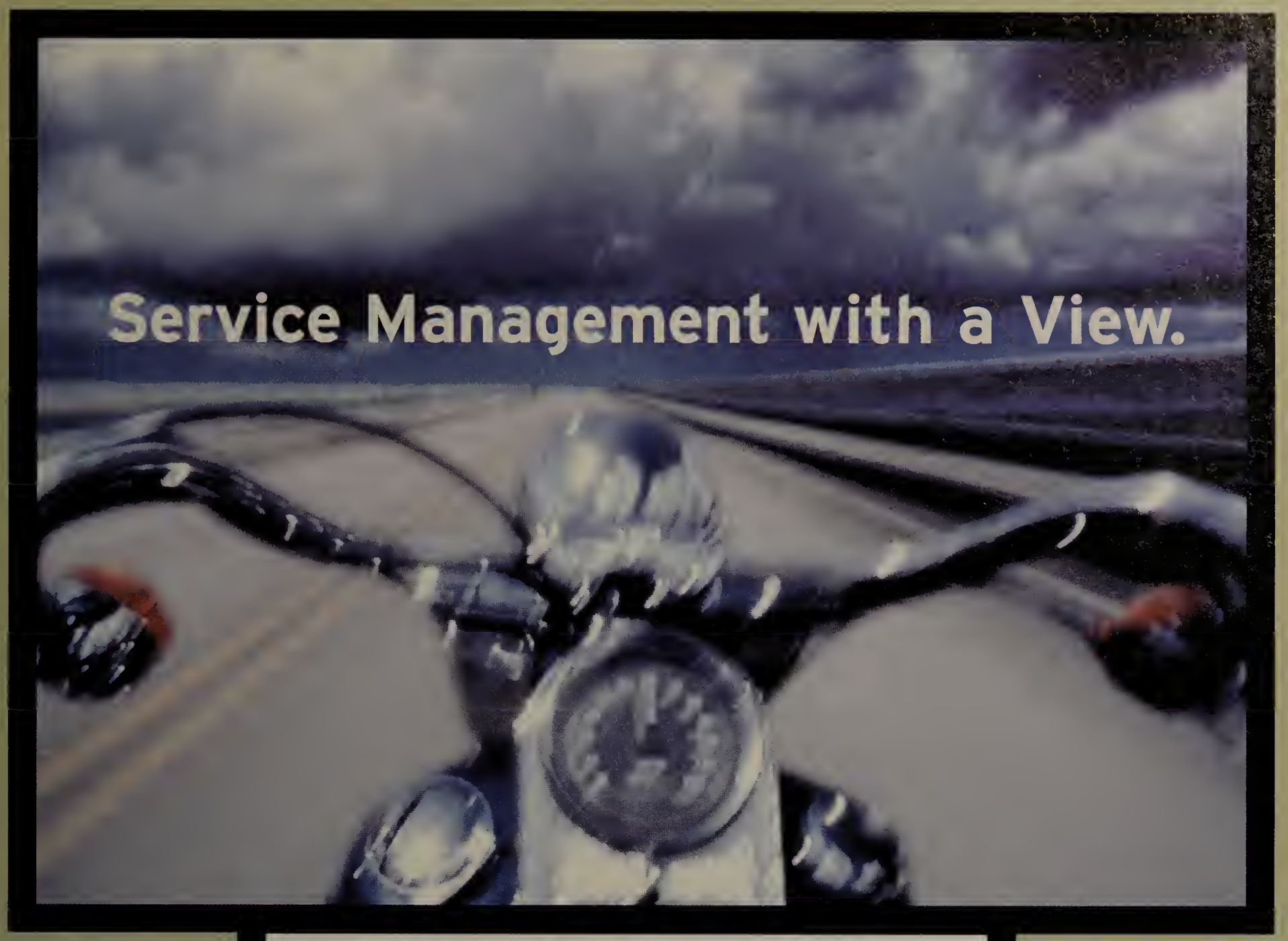
"If you ask people working on a new technology, they'll tell you that integration is harder. You've got to learn a new environment. If you could do it all yourself, most probably you would. But integration can lessen your time to market," says Arvind Krishna, director at Foundations of Internet Research at the IBM Watson Research Center in Hawthorne, N.Y.

Furthermore, market pressure may actually increase innovation, while exposure to new technologies through integration expands a researcher's knowledge, says Robert Buderi, author of the soon-to-be-published *Engines of Tomorrow: How the World's Best Companies are Using their Research Labs to Win the Future.*

Most experts agree: If integration has a long-term downside, it has yet to materialize.

— Julie Bort

JACK GALLAGHER



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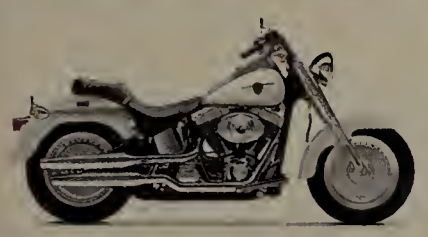

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*Harley-Davidson 2000 FLSTF Fat Boy model in White Pearl shown; Harley-Davidson 2000 FLSTF Fat Boy model in Vivid Black to be provided as contest prize.

Continued from page 88

before. Business units are responsible for technologies expected to ship as products in less than two years. Business units also create the next incarnations of existing products.

Strength in patents

Tallying up patents of a specific company is a place to begin, but only that. Research directors can't always predict which technologies will be big licensing opportunities. So some companies have started to patent more, not necessarily create more. Excessive patenting could also indicate a defensive legal strategy, in which companies document legal rights to the technology.

"If someone tries to collect a royalty, our lawyers can say, 'We've got a stack of patents, too,' " says Jim Mitchell, a Sun fellow and vice president of Sun Laboratories in Palo Alto.

Significantly, number is less important than type. Simply put, patents are either strong or weak. Strong patents are those cited by other patents. Weak patents are those that rely on strong patents.

A patent is considered exceptionally strong if it is cited 50 times, says Francis Narin, CHI's president. One example is a patent Sun received in 1996 for a method of extracting data from a markup language file and then generating other files, in different markup languages, containing the extracted data. By 2000, other vendors cited this patent 137 times. Microsoft did so in a patent for caching, Compaq in a patent for an e-mail hot link function, Sabre in a patent for an information aggregation system.

Strong patents are an indication of what CHI calls "technological strength," determined by a weighted score. CHI's rating system is based on the number of new patents a company receives, how often the company's patents are cited by others (strong/weak) and the age of the technology upon which the patent is based. Because innovation outpaces the patent process, the latter two criteria help give a truer picture of research health, Narin says.

Ironically, a company's ability to influence others only gets it halfway to the goal. To score, the company must be influenced by others' technology as well. Narin calls this "absorptive capacity." If a company has high absorptive capacity, it stays on top of big discoveries and emerging standards, and quickly incorporates these into products. For this reason, CHI watches how often a company cites scientific papers in its patents.

Absorptive capacity is critical for another reason: It's the only way to keep brilliant people. Engineers who feel included in the scientific community are likely to stay put. So finds Arvind Krishna, director of Foundations of Internet Research at IBM Watson Research Center in Hawthorne, N.Y.

"People like to see if there's an avenue for their technology ideas to get out, like standards or open source or even free downloads. Clearly it's a matter of pride," Krishna says. "We need people within our labs to work with the extended core of technology, as opposed to people who are isolated."

DAN BRYANT

With-it researchers understand that they must incorporate the business viewpoint into their developments, says Richard Parvin, Sabre's director of network infrastructure engineering.

In addition to using weighted scores from research companies, you can get a sense for absorptive capacity by noting the authors on standards proposals. Companies with researchers that routinely co-author papers with those from other companies and universities are demonstrating absorptive capacity. Such is the case at Cisco, Lucent, Microsoft, Nortel and Sun.

Another key is why a company makes its development choices. Smart vendors use their research not just to create products, but to change the rules of networking. These are the so-called disruptive technologies, in the words of Nortel's Mann.

"If you are into a market to attack a competitor, the classic move is to try to change the rules of the game. You try to change the economics of a network by employing new technologies," Mann says.

Transfer no more

Another telling indicator of R&D health is a vendor's method for getting new ideas to market quickly. Traditionally, research and development have been two separate events. Researchers would identify a new technology. When they thought it was ripe for a commercial application, they would "sell" it to their internal customers, the business units. If the business units bought into the technology, they'd turn it into products. This process is commonly called technology transfer.

"Technology transfer creates and shows a serial and reactive process, and it is exceedingly ineffective," Lucent's Martin says.

The most successful researchers have created new models in which discovery and development occur simultaneously. For instance, Lucent uses a fast-track process for breakthrough discoveries, such as the WaveStar LambdaRouter. It matches central lab engineers with developmental engineers, business managers and marketing people in the business units so that a product can be developed while it is being invented.

SunLabs relies on a more traditional technology transfer model but lets the technology creators become its long-term champions, and to move with the technology to the business unit for development. They return to the lab once the technology is turned into product, Mitchell says.

Nortel, which has no central research lab for the nearly $2 billion it spends annually on R&D, uses an approach called portfolio management. Mann's group, Emerging Business Technology Investments, has crafted itself like a venture capital firm. Working closely with the business units, the engineers and business people in this group identify promising new technologies, internal or external. If

Continued on **page 92**

POWERFUL PATENTS

Top Network World 200 companies filed more patents in 1999 than they typically do in a year, but that's only one factor in the health of research and development.

CHI Research, a firm that helps companies find technologies worth acquiring, uses "technological strength" as a way to quantify R&D health. Technological strength includes the number of patents filed, an assessment of whether those patents are strong or weak, the technology's age, the influence of the company's nonpatented technology and the company's "absorptive capacity."

Company	1999 technological strength	No. of patents in 1999	Prior five-year average, per year
IBM	6,895	2,736	1,800
Lucent	2,592	1,137	759
Intel	2,236	758	410
Sun	2,083	559	168
AT&T	1,551	318	69
Microsoft	1,441	361	142
Compaq	1,403	415	342
Novell	347	58	11
Oracle	331	89	21
Cisco	324	55	13

SOURCE: CHI RESEARCH, HADDON HEIGHTS, N.J.

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Continued from page 90

external, the group assists in the acquisition and sees the technology deposited in a business unit for development.

In fact, buying research is in itself a sign of healthy R&D. "What I want is best of breed. I don't like it when vendors take a not-invented-here attitude. It shows arrogance," says Parvin, who describes Sabre's network as "bleeding-edge" and relies on newly acquired technology from vendors such as Cisco and Nortel.

"When a company buys and buys technology, sometimes it loses key development people. This is normally only a problem for a short time," says Parvin, who finds that after the acquisition period ends, network companies support acquired technologies in the same manner as in-house ones. In fact, companies that make heavy acquisitions, such as Cisco and Nortel, have literally turned integration into an art form, he says.

RESEARCHING YOUR VENDOR

Before signing on the dotted line, network executives should:

Determine what percentage of the R&D budget the vendor is spending on centralized or long-term research.

Ask how many patents the company has been averaging each year and cross-reference that against strength rankings available from CHI Research, overall statistics from Industrial Research Institute, the National Science and Technology Board, and publications such as MIT's *Technology Review.*

Insist on meeting the company's research engineers, particularly those who invented the technology you're considering.

Ask how much interaction researchers have with other engineers and standards bodies and ask how many papers they publish each year.

If your vendor claims that its product reigns supreme because it was developed completely in-house, the vendor may be lagging in research methods. It might struggle with, ignore or simply lie about integration. In any case, take such statements as an ill omen on research health.

User input

Determining which products will be big financial winners and which will bomb is like picking winning lottery numbers. But network vendors have started hedging their bets: They're talking to users. In fact, all vendors interviewed for this article say they've made it a goal to increase contact between customers and researchers.

"The new R&D is customer-driven. We're market-focused. No longer are we designing and building a whole product [hoping to sell it]. Today, we get feedback on customer needs and then do the research," says Derek Messulam, general manager of Convergent Solutions at Telcordia Technologies in Red Bank, N.J.

The University of Pennsylvania's Kassabian cautions his peers, however. While he's had the opportunity to interact with and influence long-term research at the university's key vendors, Kassabian notes that such communication isn't a common occurrence yet.

"The vendors are reluctant to allow direct contact because it can be a significant time drain on their R&D resources," Kassabian says. "We understand that and don't want to get in their way. At the same time, we want the opportunity to have some influence and to let them know what we'll be expecting."

Lab directors such as Lucent's Martin advise users to be firm and demand the meeting. In doing so, they'll tap deeper into a vendor's intellectual future than they would through business lunches.

The message from the new R&D: Ask and you shall receive. ◪

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FROM CLECs TO APPLICATION-AWARE SWITCH VENDORS, THESE START-UPS WARRANT YOUR ATTENTION.

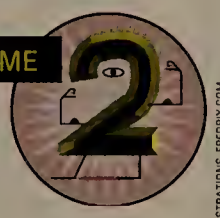
By Beth Schultz

By this time next year, some of the corporate newbies we're profiling here will have gone public, and maybe they'll have grown enough to qualify for the Network World 200, our annual ranking of the top public network vendors by revenue. Others will have been consumed by bigger, technology-hungry vendors, their products and services to live on under different corporate banners. Either way, the unfolding histories of their hot products and services are worth following closely.

One 2nd CENTURY

- **Headquarters:** Arlington, Va.
- **URL:** www.2c2.com
- **Founded:** July 1998, by Charlotte Baker, Vince Rocca, Oscar Williams and Mike Viren, who all had been marketing and technology executives at Intermedia Communications.
- **Funding:** $80 million, in three rounds.
- **President and CEO:** John Prisco, who joined 2nd Century in February 1999 from Bell Atlantic, where he held a series of senior management positions.
- **Services:** ESL, a basic package of local, long-distance and Internet access services; ESL Pro, the basic services plus e-mail, a Web server, a firewall, file-sharing capabilities and remote LAN monitoring.

The company fancies itself as ushering in the second century of communications. It also believes it's got a service model that will endure as long as the one developed by Alexander Graham Bell.



ILLUSTRATIONS: FREDRIK COM

2nd Century Communications is a next-generation competitive local exchange carrier (CLEC) that preaches the convergence gospel and believes mightily in the power of ATM.

This CLEC is delivering a host of services, including local and long-distance voice, Internet access, e-mail and Web hosting, over the same T-1 access link. At the customer premises, voice and data feed into a Vina Technologies integrated access device, which converts the traffic into ATM. Out in the WAN, multiservice switches from Convergent Networks hand off voice calls to the traditional public network and IP data to the Internet.

2nd Century already operates in 12 cities. It plans to increase the number to 35 by year-end and 48 by mid-2001. It's got the gumption and the cash. In January, the carrier pulled in a whopping $50 million in financing from a single source. A phenomenal figure for any start-up, these big bucks simply top off the $30 million 2nd Century had already accumulated in round one and two funding.

2nd Century targets small and midsize companies with its convergence mission. It wants to "e-enable them," helping such companies better compete in the new 'Net economy.

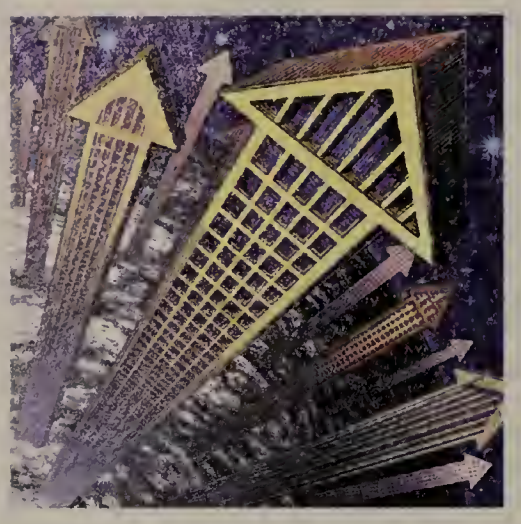
Two ADERO

- **Headquarters:** Boston
- **URL:** www.adero.com
- **Founded:** October 1998, by Robert Carney, Paul Cheng and David Crosbie, former marketing directors at QoS appliance vendor Sitara Networks; and Oliver Jones, founder of streaming video vendor Vivo Software.
- **Funding:** $33 million, in two rounds.
- **President and CEO:** Jonathan Crane, who joined Adero in October 1999 from enterprise resource planning software provider Marcam Solutions, where he was chairman and CEO.
- **Services:** GlobalWise Content; GlobalWise Streaming; GlobalWise Commerce; GlobalWise Context; GlobalWise Applications.

"Adero" is borrowed from the Latin verb meaning "I will have been there."

The need for Web content distribution continues to spawn interesting new companies, Adero among them. Like competitors Akamai Technologies (one of the 10 companies we watched in 1999), Digital Island and SightPath, Adero provides caching and replication services from servers it places around the Internet. Content distribution is just the first step for this start-up.

What Adero is really shooting for is the creation of a global server network on which rides its basic content distribution service, plus more



Where are they now?

Of the 10 young companies *Network World* tracked last year, half went public, mostly in staggering IPOs. Two were acquired, another is headed for the same fate, and the final two remain independent. Here's a closer look at how our picks have fared.

Company	Status	Highlights to date
Akamai Technologies *www.akamai.com*	Went public Oct. 29, 1999; for 1999, reported $4 million in revenue and a $57.5 million net loss.	Grew customer base to nearly 400; in fourth quarter 1999, forged into streaming media content delivery with acquisitions of Network24 Communications and Intervu; partnered with CLECs and Internet players, including AOL, for last-mile connectivity.
Bluestone Software *www.bluestone.com*	Went public Sept. 24, 1999; for 1999, reported $15.6 million in revenue and a $15.1 million net loss.	Shipped industry's first dynamic XML server and Release 6 of its Sapphire/Web Java application server; extended relationship with distributors; brought in new top managers; added customers such as ClickMail.com and Food.com.
Covad Communications *www.covad.com*	Went public Jan. 22, 1999; for 1999 reported $66 million in revenue and a $195 million net loss.	Extended DSL service to multiple U.S. cities, including Atlanta, Chicago and Seattle; began voice-over-DSL trials; forged agreement with AT&T and Qwest that resulted in nationwide DSL connectivity; ranked as fastest-growing NW200 company.
Foundry Networks *www.foundrynet.com*	Went public Sept. 28, 1999; for 1999, reported $134 million in revenue and $23 million in earnings.	Extended product line with NetIron core routers, Layer 4-7 switches, firewall load-balancing features and new BigIron modules; grew its installed base to 1,500 customers, including AT&T, Industrial Light & Magic and the U.S. Army.
Inktomi *www.inktomi.com*	Reported $71 million in 1999 revenue and $24 million net loss for the year. (Public since June 1998.)	Signed on major new customers for its shopping and search engines, including MSN and Merrill Lynch OnLine; teamed with Digital Island and RealNetworks on development of a global streaming media network; released several new products, including Traffic Server 3.0 and search engine services.
Manage.Com *www.manage.com*	Privately held, so financials undisclosed; raised $14.5 million in second-round venture funding.	Developed the standards-based manageXML language and rolled out a number of new services, including eChristmas Readiness Assessment service; my.Manage.com, for online performance monitoring among e-business communities; and the "extranet-ready" FrontLine e.M software, which Top Layer Networks is using in its Layer 7 switches.
Network Alchemy *www.networkalchemy.com*	Acquired by Nokia March 3 for $335 million in stock.	Added load-balancing and failover features to its CryptoCluster servers; signed on customers such as Conoco, Instinet, MasterCard International and Monsanto; aligned with providers such as AboveNet Communications and Sprint.
Nextlink *www.nextlink.com*	Merger with Concentric Network pending; the $2.9 billion deal is expected to be finalized this quarter.	Boosted number of LMDS-based wireless frequencies it owns through two acquisitions; began offering wireless broadband service in multiple U.S. cities; brought in new top executives, including Dan Akerson as chairman and CEO.
Red Hat Software *www.redhat.com*	Went public Aug. 11, 1999; for 1999, reported $33 million in revenue and $58 million net losses.	Forged strategic alliance with Dell to have Red Hat Linux factory-installed on PowerEdge servers; agreed to license and distribute IBM's Java for Linux; acquired open source software maker Cygnus Solutions and e-commerce payment processing software vendor Hell's Kitchen Systems; fleshed out product line with Version 6.1 of its operating system and an e-commerce server.
Ukiah Software	Acquired by Novell in June 1999; terms of the agreement were not disclosed.	Novell incorporated Ukiah's policy-based management software into ZENworks for Networks and ZENworks for Servers; Ukiah stand-alone products discontinued.

Three BOWSTREET

- **Headquarters:** Portsmouth, N.H.
- **URL:** www.bowstreet.com
- **Founded:** January 1998, by network management software veterans Frank Moss, formerly chairman and CEO of Tivoli Systems, and Preferred Systems co-founders Jack Serfass, Joe Sommers and David Sweet.
- **Funding:** $27.6 million, in two rounds.
- **President and CEO:** Bob Crowley, who joined Bowstreet in August 1999 from XML software provider Arbortext, where he was president and CEO.
- **Product:** Bowstreet Web Automation Factory 1.0

The company was founded on Bow Street, in historic downtown Portsmouth, N.H., on the waterfront.

Network World's "Wired Windows" columnist Dave Kearns bestowed his networking Most Valuable Player for 1999 Award on Bowstreet founders (*NW*, Jan. 17, p. 26). It only seems logical that we closely track what these guys are up to. And what's that? Business-to-business e-commerce with big doses of automation technology, XML and directory services, manifesting themselves as a new e-commerce standard and a software environment.

The standard, known as the Digital Services Markup Language (DSML), presents directory services information in XML. AOL/Netscape, IBM, Microsoft, Novell, Oracle, Sun — anybody who's anybody in directory services — support DSML and are helping with further development of it.

The product, Web Automation Factory, lets companies customize business-to-business e-commerce sites and integrate content — internal or external — virtually at will. In its five months of shipping, the package has already been put to use at Fortune 500 companies such as Federal Express, IBM, Merrill Lynch and at dot-com ventures such as Adauction.com, Get Connected and NetRatings. In fact, Bowstreet reports that during the fourth quarter 1999, it entered into contracts valued at more than $1 million.

E-commerce, XML and directory services all promise to be big technologies in the 2000s, and Bowstreet is definitely at the crossroads.

advanced functions, such as transaction processing. With GlobalWise Commerce, for example, a company could rely on Adero to process e-commerce transactions on servers in close proximity to their customers. Pushing the worldwide angle, GlobalWise Context will let a company localize and personalize e-commerce content and transactions. With GlobalWise Applications, companies will be able to run business-to-business and business-to-consumer applications on Adero servers across the Internet.

The services ride over Adero's GlobalWise Network, which includes more than 70 nodes in 28 countries, in partnership with 17 Tier 1 Internet backbone providers. To speed content delivery over that network, Adero recently acquired software companies StarBurst Software and Fast Engines.

Nearly 50 businesses have signed on with Adero, including Barclay Card, BigDeal.com and the *International Herald Tribune*.

Four LOUDCLOUD

- **Headquarters:** Sunnyvale, Calif.
- **URL:** www.loudcloud.com
- **Founded:** September 1999, by former AOL/Netscape executives, including Ben Horowitz and Marc Andreessen.
- **Funding:** $68 million, in one round.
- **CEO:** Ben Horowitz, who left his position as vice president and general manager of America Online's E-commerce Platform Division to found Loudcloud.
- **Service:** Smart Cloud; Opsware automation technology.

THE NAME

Founders wanted to incorporate the word "cloud" in the company name because in the telecom world, that's where services live. "Loud" sounded big and important, and with "cloud" it had a nice ring and was easy to spell — plus, it sure conjures up a better image than "Darkcloud."

We all remember Marc Andreessen as the boy genius who created the first graphical browser, founded Netscape and launched the Internet revolution. Granted, that's probably more credit than any one person is due, but Andreessen does have an aura about him that piques one's curiosity. So it was with much fanfare that Andreessen unveiled his new start-up in February.

As is the fashion these days, Loudcloud has entered the outsourcing realm. It does so with Web site automation technology called Opsware and a services package called Smart Cloud. Through Smart Cloud, a dot-com operation gets the software, hardware and Web operations infrastructure — Web servers, databases, storage and the like — it needs to launch an e-commerce venture. Pretty standard fare when it comes to Web hosting, until you factor in Opsware.

With this technology, Loudcloud automates tasks that need to be done by hand elsewhere. The software can adjust capacity, reconfigure a server, balance the load among servers, tune the operating system kernel and more. If an e-commerce site is being bombarded by heavy volume, for instance, a manager can tell Opsware to add more capacity. Opsware will start extra rack-mounted computers and disk arrays.

Loudcloud has grabbed a wholesome $68 million in funding and has teamed with prominent networking and Internet players for use of their respective products and services. Partners are EMC, Exodus Communications, GlobalCenter, Hewlett-Packard, iPlanet, Oracle and Sun.

As of its launch, Loudcloud had already signed seven Internet companies as customers. Among them are DreamLot, for a next-generation car shopping site; HomeGain, for its home seller Web site; and gift portal Wish.com.

Loudcloud is indeed making a lot of noise in the online world.

Five NETWORK ICE

- **Headquarters:** San Mateo, Calif.
- **URL:** www.networkice.com
- **Founded:** April 1999, by Clinton Lum, Greg Gilliom and Robert Graham, all formerly in product development and management positions at Network Associates.
- **Funding:** Undisclosed amount from company founders and Intel capital.
- **President and CEO:** Greg Gilliom, who had been vice president and chief technology officer at Network Associates.
- **Products:** BlackICE and ICEcap intrusion-detection software.

THE NAME

Company founders took the name from *Neuromancer*, a cyber pulp fiction novel in which author William Gibson tells the story of a hacker who has to crack into "Corporate Ice," an artificial intelligence network protected by intrusion-detection technology.

Hacking abounds, and any network is vulnerable. That's really all that needs to be said about why we've included an intrusion-detection company on our watch list.

But we can say plenty more about why Network ICE is the particular company we chose. The highlight is its technology. In a comparative review conducted last year for *Network World*, Network ICE took home our World Class Award for the excellent tracking and alerting capabilities of its BlackICE and ICEcap tools. Subsequently, those products earned our Best of the Tests Award for scoring in the top 10% of all tested in 1999, with a 9.3 out of 10.

When the agent-based BlackICE detects uninvited visitors, it reports the intrusion to the ICEcap management module. In turn, ICEcap analyzes the intrusion information from the agents and uses it to spot widescale attacks on a network.

Intel last month announced it is licensing the Network ICE software for use with its digital subscriber line modems and other products. It also has taken an equity stake in the company.

Six NOWONDER

- **Headquarters:** Sunnyvale, Calif.
- **URL:** www.nowonder.com
- **Founded:** March 1997, by Chris Derossi and Konstantin Othmer, who held executive positions with General Magic and Catapult Entertainment, respectively.
- **Funding:** $65 million, in two rounds.
- **CEO:** Anthony Lye, who joined the company in April 1999 from event-notification software vendor Categoric Software, where he was vice president of marketing.
- **Service:** Online marketplace for technical support.

THE NAME

The NoWonder name comes from the common response people give tech-support providers after they've helped solve a problem. Says the user, for example: "No wonder I couldn't get that program to open! I didn't realize I had deleted the needed file."

NoWonder has all the makings of a successful e-business — prominent backers (including eBay Founder and Chairman Pierre Omidyar), overflowing coffers and, perhaps best of all, a pretty cool solution to a problem that has plagued user organizations since the advent of networked PCs: effective technical support.

NoWonder provides a friendly online resource for computer users with questions about software, hardware, programming and the like. A user has the option of getting help while "talking" to a technician in a live chat session or via e-mail from a qualified expert. For a particularly troublesome scenario, a user can grant shared desktop access so a technician can actually fix the problem. For a minor quirk, a user can simply browse through a list of Web sites and link to those that might help him remedy the problem on his own.

To date, a half-million registered users have tried NoWonder's online help, supplied by thousands of technicians. Customers include AOL/Netscape, Apple and Microsoft, and partners include McAfee.com and SkillsVillage.com.

Now NoWonder's challenges are bringing on additional corporate service providers and IT consultants and building a robust infrastructure for the sale and delivery of support services. NoWonder will charge fees to service providers that use its infrastructure, and technicians will be chosen for the live help sessions through a reverse auction bidding process.

Are technical support e-marketplaces the wave of the future? Keep an eye on NoWonder to find out.

Seven QUANTUM BRIDGE

- **Headquarters:** North Andover, Mass.
- **URL:** www.quantumbridge.com
- **Founded:** October 1998, by Anthony Zona, who had been in product management at Lucent; and Jeff Gwynne and Jeffrey Masucci, co-founders of IPA Technologies, which provided consulting to broadband equipment vendors and service providers.
- **Funding:** $22 million, in two rounds.
- **President and CEO:** Anthony Zona, most recently product manager for Lucent's WaveStar access products.
- **Product:** Optical Access System, comprising the QB5000 Optical Access Switch and the QB100 Intelligent Optical Terminal.

THE NAME

Quantum refers to units of energy, such as light, but it also means large, as in quantum leap. While the last mile is the shortest part of the public network, paving it with light represents a significant challenge, or Quantum Bridge.

Of all the hot, young optical networking companies out there, Quantum Bridge Communications is the one that gets closest to the enterprise. Provided network conditions are right, service providers need only deploy the company's Optical Access System and they can offer any size business customers affordable bandwidth services, ranging from 1M to 100M bit/sec and into dedicated wavelengths.

Quantum Bridge differentiates itself through the use of a special protocol that makes it possible to split wavelengths of light into time slots. That means one wavelength can be shared by up to 32 customers. Carriers would have the option of letting enterprise users add and drop bandwidth, in 1.7M bit/sec increments, using secure Web connections.

Also on the plus side, Quantum Bridge's system uses passive optical networking (PON) technology. With PONs, carriers can deploy these high-bandwidth services simply by placing the Quantum Bridge gear at the service node and on the customer premises. They do not need to invest in more costly equipment for provisioning ATM to enterprise users.

Cable provider Comcast has been testing the products since January, and four or five other service providers will get the gear soon for testing. Quantum Bridge expects to begin drawing revenue on the Optical Access System in June or July.

Eight RIVERSOFT

- **Headquarters:** San Francisco
- **Founded:** In February 1997 by Philip Tee, who had been chief technology officer at message management company Micromuse.
- **Funding:** $50 million, in four rounds.
- **CEO:** Dominic Gattuso, who joined RiverSoft in November 1999 from Inktomi, where he was instrumental in expanding European operations.
- **Products:** i3 philOSophy network management operating system; OpenRiver interventionless management application.

THE NAME

The company founder struck the initial funding agreement with his angel investors while dining in the River Room of London's Savoy Hotel.

Something is afoot in the systems management industry: Fledgling and established vendors alike are heavily pushing automated, integrated management systems for networks, systems and applications. Start-up RiverSoft is in the thick of it.

In fact, RiverSoft has one of the most far-reaching strategies, reports Dennis Drogseth, a director at market researcher Enterprise Management Associates, in the Feb. 7 newsletter on network systems management he penned for *Network World*. Granted, everybody has a lot to prove in this market and plenty of naysayers to convert, but for a young company, RiverSoft is doing convincingly well.

In January, the company debuted the network management operating system, called i3 philOSophy, and announced plans to push it as a de facto operating system. I3 philOSophy essentially acts as middleware, allowing smoother operation between network applications and the servers they ride on. One of its licensees is SilverBack Technologies, another company on our watch list.

The first application, OpenRiver, detects and maps the connectivity of networks and their subsequent changes. Because of the automation of typically manual processes, customers don't accumulate the high costs often associated with change management.

RiverSoft is targeting any organization with a large and complex network, service provider or user enterprise. Enterprise customers include Booz Allen, Nomura Research Institute and Goldman Sachs. In one of its latest moves, RiverSoft promises to divert some of the $35 million in round-four financing it received in late February to building a world-class support operation for these and future customers.

Nine SILVERBACK

- **Headquarters:** Billerica, Mass.
- **URL:** www.silverbacktech.com
- **Founded:** June 1999, by John Igoe, Robert Klotz and Deborah MacCallum, all of whom had been remote network management specialists at Nortel Networks.
- **Funding:** $6.8 million, in one round.
- **President and CEO:** John Igoe, most recently vice president of global technical service for Nortel.
- **Service:** InfoCare.

THE NAME

Getting some fresh air during an early strategic planning meeting, founders chose the company name when they happened upon a statue of a silverback gorilla in London's Chelsea Harbor. The adult male gorilla that leads a family, the silverback is characteristically mature, dependable, loyal, passionate and protective — all admirable traits in a primate or a networking company.

SilverBack Technologies has latched onto the application service provider (ASP) concept, but it isn't hosting anything, at least not remotely. In an unusual twist, SilverBack offers on-site hosting of network management applications.

SilverBack gives customers a homegrown, Linux-based device that runs off-the-shelf monitoring, reporting and security tools and customized application software. The box sits on a critical path, say off the main router, gathering, integrating and then correlating information from those tools. Subscribers to SilverBack's InfoCare service can view the data locally through a Web interface, in real time, to find out what device or application has failed; why; how the network might be impacted; and how the problem might be fixed. Because the InfoCare service is local, it isn't subject to the vagaries of Internet connections from which other ASPs may suffer.

SilverBack unveiled InfoCare in late February. It offers network alerts, asset inventory, network infrastructure performance monitoring and security scanning applications. Later iterations will add intrusion detection, root cause analysis, application monitoring and network virus scanning.

Ten TOP LAYER NETWORKS

- **Headquarters:** Westborough, Mass.
- **URL:** www.toplayer.com
- **Founded:** In January 1997, by switch engineers from FORE Systems and Digital.
- **Funding:** $31.5 million, in three rounds.
- **President and CEO:** Bruce Cohen, who joined Top Layer in June 1998 from Web software application company NovaSoft Systems, where he was president and CEO.
- **Product:** AppSwitch 2500.

THE NAME

"Top Layer" refers to Layer 7, or the application layer of the OSI model. Company President and CEO Bruce Cohen wanted to convey the idea that Top Layer's AppSwitch 2500 could guarantee a specific level of bandwidth and set priorities based on Layer 7 application information.

Once known as BlazeNet and focused on bringing application-aware switches to small companies, this start-up vendor is now known as Top Layer Networks and is intent on seeing its product deployed in big enterprise networks.

The shifts came following the arrival of Bruce Cohen as president and CEO, and his recognition that BlazeNet could get a lot more mileage of the technology if cast differently. He wanted to promote the importance of the company's policy engine and the fact that it could prioritize traffic based on Layer 7 application information.

Looks like his thinking was sound. AppSwitch 2500 has won industry kudos all around, including our own Best of the Tests Award for 1999. Our testing, conducted by *Network World* Test Alliance member John Bass, verified that the switch can achieve wire-speed performance while handling Layer 2 and 3 bridging and routing functions; acts as an application-level firewall; and can prioritize the flow of network traffic by application. Bass, who is technical director for Centennial Networking Labs at North Carolina State University, said he was skeptical at first but that the switch definitely passed his muster.

And, perhaps more important, the AppSwitch 2500 has passed the rigors of various enterprise users. Top Layer is growing an impressive customer list, populated by names such *The Boston Globe*, Bear, Stearns, and, recently, Amazon.com.

Whether Top Layer ever reaches the heights of Cisco remains to be seen. But it has made an impressive start.

LYNDA WEITZ-NORTON

VENTURING INTO START-UPS

No fewer than 34 venture-capital firms are involved in financing the start-ups we're watching this year. (Only one company, Network ICE, is financed entirely by private investors.) The only firms funding more than one start-up on our list are:

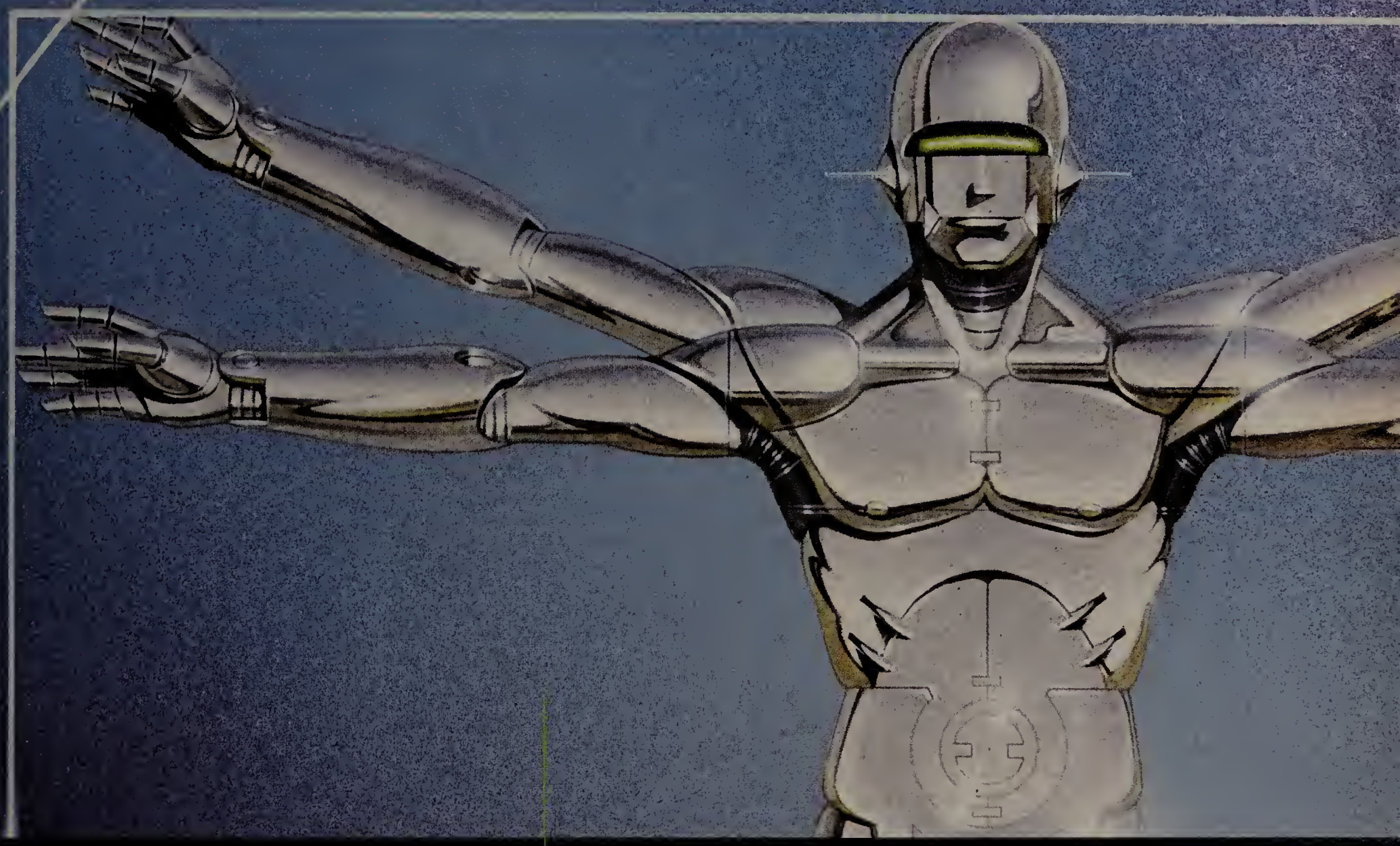
Fidelity Ventures
- Adero
- Top Layer Networks

Integral Capital Partners
- Bowstreet
- NoWonder

Matrix Partners
- Bowstreet
- SilverBack Technologies

Morgan Stanley Dean Witter
- Loudcloud
- RiverSoft

North Bridge Venture Partners
- 2nd Century Communications
- SilverBack Technologies



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How leaders lead

By Cassimir Medford

Bobby Johnson Sr. spent 26 years on combat alert. He kept a leather bag packed, ready for a call that could come at any time, be it the middle of the night or during a Sunday barbecue. Bobby Jr. remembers his father grabbing that bag, patting him on the head and appointing him man of the house. "If anything happens to me, you take over the job of protecting this family. Do you understand?" Then off he'd go.

Bobby Sr. was a member of an elite U.S. Army Special Forces unit. His discipline and commitment in the face of life-threatening circumstances made a lasting impression on his son.

Today, the younger Johnson is more than three decades removed from those days when his father would issue him field commands to take charge of the family unit. Just returned from his own "mission," a business trip to Japan with a pit stop in Southern California, he is distracted and jet-lagged. It comes with the territory, running gigabit switch vendor Foundry Networks, one of the hottest network vendors in the world and an absolute darling of Wall Street. Based in San Jose, Foundry posted one of the highest first-day percentage gains in IPO history when its share price more than quintupled last September. Leading a company on the fast track through start-up and into its early growth phase can be stressful, particularly on days like today.

"When I get stressed, all I have to do is think back to my father's job. My job is a piece of cake in comparison; it's not life and death," says Johnson, who is Foundry's president and CEO.

Well, not literally. But Johnson says he runs Foundry as if it *is* do or die. He is a demanding perfectionist. "'Do it over until you get it right' is his mantra," says Ken Cheng, Foundry's vice president of marketing. "[Johnson] is as demanding as anybody in this industry."

Johnson runs the company with a drill sergeant's attention to detail — the hours are long and the mood is sober. His in-your-face style can be taxing, but the rewards are uniquely attractive at Foundry, which is 60% employee-owned.

"I demand a lot, but I lead by example. No one puts in more hours than I do," Johnson says. "My style, which I learned at Hewlett-Packard, is management by walking around. I meet with my staff informally all the time. But for all my demands, our decisions are made by the group."

A student of military history and strategy, Johnson brings a lot of combat techniques to the ultracompetitive world of networking. "The goal of business is pleasing the customer, but you have to get to the customer first, and military strategy is useful in gaining market leverage," he says. "We're a fast-moving company and we are trying to outmaneuver our competitors."

That's an apt job description for the few dozen executives, most of them men, who call the shots in the roller-coaster world of networking. The potential rewards are astronomical, but the personal costs are steep — many of them routinely work 70- to 80-hour weeks and spend at least 40% of their time on the road. They must keep the sometimes-competing interests of stockholders, employees, customers and a horde of hungry analysts in precarious balance when making key decisions.

No fear, no failure

"There isn't a lot of room for failure in this business," says Gordon Stitt, president and CEO of Extreme Networks, a Foundry competitor in Santa Clara. "This environment is changing so fast that you need to nudge people and ask, 'Have you looked at different alternatives, or did you use only the mind-set you came here with?' I think that's the most important aspect of leadership."

Prodding people to look at things differently is common among network

ON LINE

SHELLING OUT THE BUCKS. Which NW200 companies spent the most on R&D last year? Find out in our topic specific charts. You'll also see which companies made the most profit and which had the biggest drops in revenue.

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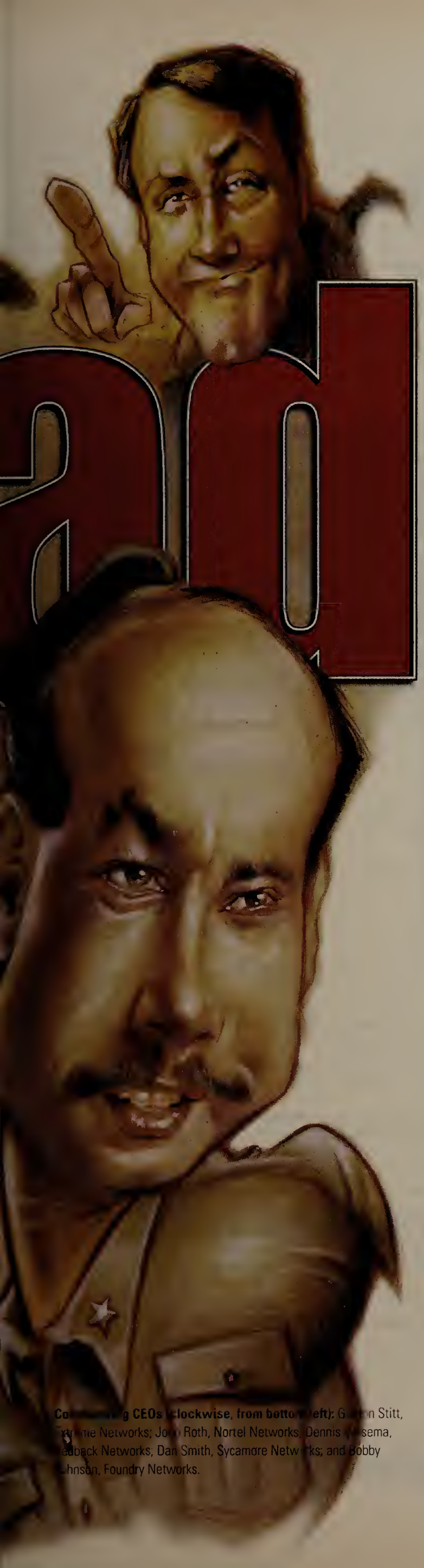

Co[illegible]g CEOs (clockwise, from bottom left): G[illegible]n Stitt, [illegible]me Networks; Jo[illegible] Roth, Nortel Networks; Dennis [illegible]sema, [illegible]dback Networks; Dan Smith, Sycamore Netw[illegible]ks; and Bobby [illegible]hnson, Foundry Networks.

FROM MILITARISTIC TO LAISSEZ FAIRE, TOP NETWORK EXECUTIVES FAVOR DIFFERENT STYLES FOR KEEPING THEIR COMPANIES OPERATING SMOOTHLY.

leaders. Many have lived through disruptive technological changes that have relegated whole segments of the network industry to the technological junkyard. They cannot afford to become complacent or apply old formulas to new problems.

For Stitt, that means creating an ever-widening field of options. In twice-weekly executive meetings and quarterly brainstorming sessions, Stitt prods his executive team with rapid-fire questions designed to uncover new ways of doing things.

"Everything is challenged at these meetings. That has become such a part of the company culture," Stitt says.

The meetings are casual in style but combative in content and procedure. For Stitt, this aggressiveness is part of a chain reaction triggered by Extreme's board of directors and investors who hold his feet to fire. They demand that he challenge convention, and Stitt in turn exhorts his lieutenants to think unconventionally.

"The way you make your mark as a small company is to be disruptive — to bring out new technology and make business moves that cause people to take notice," Stitt says.

"I demand a lot, but I lead by example. NO ONE puts in more hours than I do."

Bobby Johnson, president and CEO, Foundry Networks

Taking it on the road

For larger, established companies, particularly those in the staid telecommunications industry, the executive style is surprisingly informal. John Roth, president and CEO of Nortel Networks, keeps meetings to a minimum. He prefers e-mail. At any given point in the day he will have a number of discussion threads going among his executives, and these threads extend out on the road. That may be a good thing because Nortel executives, particularly Roth, travel three to four days per week.

In fact, Nortel executives travel so much that they meet more often at customer sites than they do in the office. "We come in to the city we are traveling to one night early and hold our meetings then," Roth says.

The discussions at the customer site are usually short because many of the issues have been vetted out in e-mail. "Usually all we have left to talk about are the deltas — the changes that have occurred in the last little bit," Roth says. "The management team at Nortel has been together a long time, and because we keep our discussions ongoing, we can get into each others' heads — we understand how the others think."

Even when he convenes formal meetings, Roth doesn't necessarily lead them. He lets his executives champion different causes and issues, and he expects them to own the issue during the meeting and long after it has ended. For crucial issues, Roth arranges cross-functional teams mixed with veterans "who have scars" and young warriors who bring unbridled enthusiasm. The teams have a surprising degree of autonomy but must check in periodically.

"I use e-mail to monitor the progress of the team. I will let account executives decide if they need me to visit a customer or make some important call, but generally I give them autonomy," Roth says.

Sticking to the plan

While Roth eschews formal meetings, they are the order of the day at Sycamore Networks, a 2-year-old optical systems firm in Chelmsford, Mass. President and CEO Dan Smith, a network veteran, meets every Monday at 7:30 a.m. with his top executives and quarterly with director-level executives.

At the quarterly off-site meetings, the executives set the company's business plan. It is very detailed so that functional groups can take ownership. The goal is to decentralize day-to-day decision-making so Smith can focus on the most critical issues.

The weekly meetings begin with a series of functional reports meant to keep everyone up to date. Executives can measure progress against the overall business plan and its milestones.

"Our meetings tend to be thorough because the stakes in our business are high. If a 2.5-gigabit circuit goes down, that's the equivalent of 32,000 phone calls that drop on the floor," Smith says. "On the enterprise side, you lose a link, no big

deal. But our mistakes turn into congressional hearings."

The weekly meetings are relatively routine and noncombative. Smith gives his executives autonomy as long as it doesn't conflict with the firm's overall strategy. The goal is neither consensus nor debate — it's adherence to plan. "We are decentralized, so we expect the different functional groups to make decisions. But there are times when I've got to make a decision and say, 'This is where we are going to go,' " Smith says.

Brainstorming and dogma

At many of the leading network companies, the business plan can take on biblical proportions. It's more than a reference guide; it's dogma. Every move is measured against that plan.

At switch vendor Redback Networks, executives hash out and adjust the plan at quarterly off-site meetings. At the meetings, executives are divided into five working groups of two people and charged with envisioning what the company will look like in three years. Each group presents its view, after which the common elements of the five reports are kept and everything else is discarded. The common elements are crystallized into a strategy. Then the executives group into threes and come up with 12-month intermediate plans based on the goals of the three-year strategy.

"It's completely democratic. We vote at every step," says Dennis Barsema, president and CEO of Redback in Sunnyvale, Calif. "We decide on what takes priority. We use a brainstorming technique where we go around the table until everyone has exhausted his last thought."

Like Sycamore's Smith, Barsema gives his executives autonomy within the constraints of the business plan, but he avoids other formal processes.

"I leave it up to the functional groups to decide whether they want input from the senior staff," Barsema says. "They could ask for information or more resources. They could use the two-week meetings to seek input or they can do it at any other time. We try to be flexible."

"Ultimately, it's my call. The worst thing to do in this business is to NOT MAKE a decision."

Gordon Stitt,
president and CEO, Extreme Networks

Making decisions

In the high-flying world of networking, infant companies are vulnerable. They live on a short financial leash and must make their mark quickly or die. Established companies must jealously guard their turf from intruders. It's a pressure-cooker existence that forces the executives at the top to summon extraordinary resources to deal with complex market demands. They institute processes that cut down the degree of difficulty in decision-making, but sometimes the processes break down.

"At times, not everybody is behind an idea, but we have to make a call," Extreme's Stitt says. "Ultimately, it's my call. The worst thing to do in this business is to not make a decision."

Medford is a longtime networking writer.

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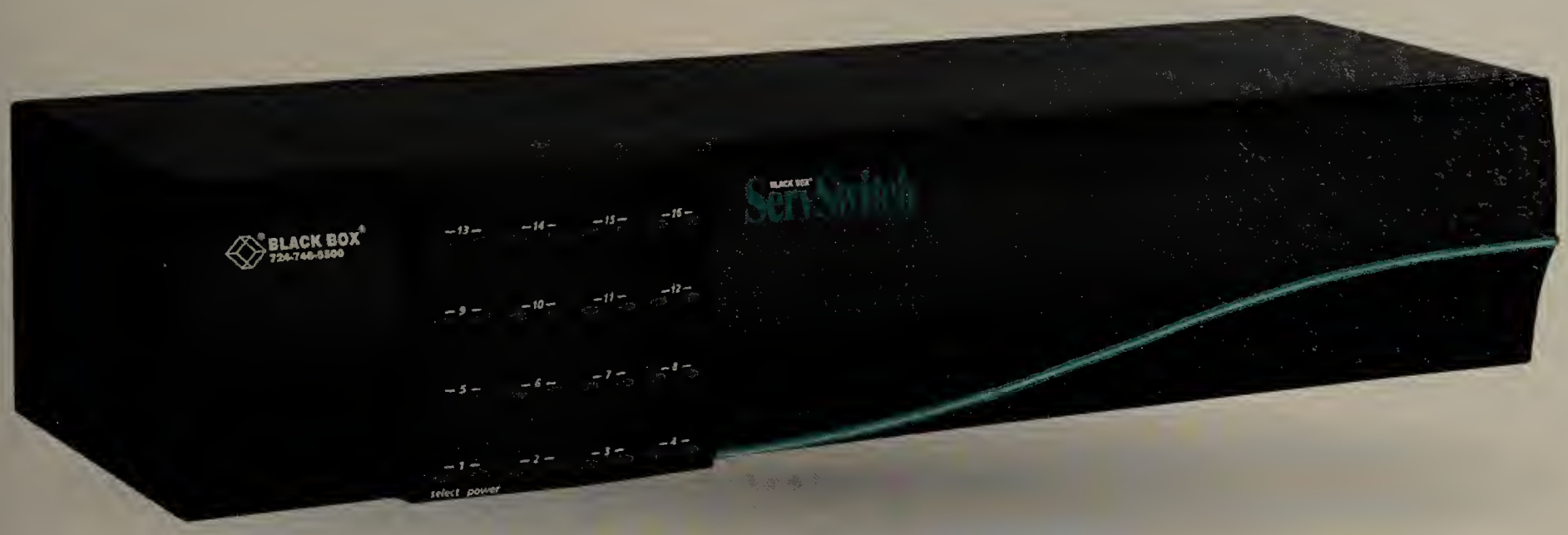

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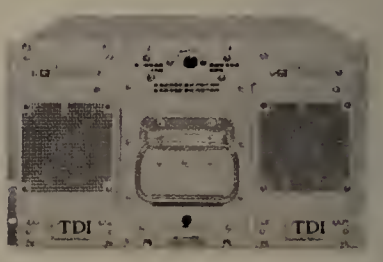

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Winning customer support

VENDORS FACE MYRIAD PROBLEMS IN PROVIDING QUALITY CUSTOMER SUPPORT, AND THE SOLUTION MORE OFTEN THAN NOT IS THE WEB.

By Paul Desmond

In early 1998, Delta Air Lines embarked on an ambitious project to upgrade its WAN capacity to airports across the country. It hired Qwest Communications to lead the effort.

Before too long, problems cropped up, says Paul Millard, Delta's vice president of engineering. Qwest had trouble getting lines provisioned from regional Bell operating companies and securing permits from airport authorities. As a result, schedules slipped.

To make matters worse, Qwest fell down when it came to informing Delta about the delays.

"Quite often, we didn't know until the eleventh hour that things were not going to happen when they were supposed to happen," Millard says. "A little advance warning would've helped."

At the same time, Delta had problems with Qwest's customer service call center. "It seemed like it was under construction during the early stages of the project," Millard says.

Flash forward to early this year, and things are much smoother. "I've had no real complaints recently," Millard says. "I think it was a case of Qwest hiring the right talent and getting internal processes in place."

Good service can — and does — make customers believers in a vendor or service provider. Often customer service is a key selling point a start-up vendor will use to attract its first customers. "We'll give you the attention a bigger company can't," the pitch goes.

Ron Schorsch, senior director of customer service at Cisco, points to an old *Harvard Business Review* study that demonstrated the importance of customer service. If a customer registers 4.5 or above on a 5-point scale measuring satisfaction with customer service, "that customer will be incredibly loyal," Schorsch says. "They become apostles for your company."

Support problems marred the early stages of a WAN overhaul Qwest Communications undertook for Delta, but the turbulence seems to have settled now, says Paul Millard, vice president of engineering for the airline.

JERRY SIEGEL

Cheryl Currid, president of consultancy Currid & Co. in Houston, puts it another way: "Bad customer service has a way of getting rid of customers."

Where's the service?

But vendors face plenty of obstacles in their effort to provide quality customer service, especially as they grow from start-ups to substantial entities worthy of the Network World 200.

Going the Web way

When asked,

"How do you assess the importance of the Web in providing customer service?" vendor executives said:


DAN BRYANT

"Through 'Ask Dudley,' we get wind of what the next top call drivers coming into the business will be. People tend to go to Ask Dudley first, especially the power users."

Manish Mehta, director of online support, Dell


PATRICIA BARRY LEVY

"It's critical. You need to have different ways for customers to communicate with you. The Web is a critical category and a growing category."

Afshin Mohebbi, president and chief operating officer, Qwest Communications


ADAM AUELMPG

"It's becoming more and more important with our Interact product, which is a Web-based application customers can use to open trouble tickets. We're going to see more and more of those kinds of tools going forward."

Meg Moschetto, senior manager, frame relay marketing, MCI WorldCom


MATTHEW MCKEE

"It's huge. We have a huge program in play working with a number of dot-com companies to help accelerate our capabilities and add functionality [to our customer support site]. We think that's going to be the most dramatic change we make in our entire system in 2000."

Peter Mercury, vice president and general manager for customer services, Compaq


CINDY CHARLES/MPG

"The Web is a very significant piece of our ability to provide customer service."

Ron Schorsch, senior director of customer service, Cisco

The biggest obstacle, Schorsch says, has to do with people — finding, training and keeping them. For Cisco, the key is to keep employees stimulated and engaged. That often comes down to training them continually to do their jobs better.

"We do quite a bit of e-learning. We've got about 60 modules available to help train employees on processes, systems and capabilities in providing excellent customer service," he says. All Web-based, the modules let employees train at their own pace, even at home.

But the training shouldn't stop with employees, says Currid, who advocates for vendors to come up with interesting, blanket multimedia training programs for customers. "Why they don't . . . is beyond me. You won't keep customers if you don't take care of them with training," she says.

Mergers and acquisitions can compound the customer service problem. Maybe you were happy with the customer service you got from a particular vendor but that knowledgeable technician you always called is nowhere to be found since the company's acquisition.

Carriers, including MCI WorldCom and various ISPs, face such issues as they grow through acquisitions, says Rosemary Cochran, a principal with Vertical Systems Group, a consultancy in Dedham, Mass. "Overnight, customers find they're part of a different group and end up with different procedures and service," she says.

In the wake of its frame relay outage last summer, MCI WorldCom was roundly criticized for not keeping customers informed of their networks' status. "Some customers were left in the dark for several weeks about when their service was going to be restored," says Lisa Pierce, telecom analyst with Giga Information Group, a market research firm in Cambridge, Mass.

New products present another challenge because customer service representatives have to climb a learning curve. Consider the problems RBOCs had for years supporting ISDN, Cochran notes. Users calling with configuration questions and the like consistently confronted customer service reps who had little ISDN knowledge.

When companies experience rapid growth, it's especially challenging to hire and train customer service personnel fast enough and put the proper procedures in place, particularly for dealing with major problems. Pierce thinks Qwest fell victim to these issues. "Qwest had another challenge in that it was going from serving more wholesale customers, where there's not a lot of customer service, to retail, where there's lots," she says.

Customer service the Web way

Afshin Mohebbi, president and chief operating officer for Qwest, takes issues with Pierce's contentions, saying customer service problems such as those Delta faced are the exception, not the rule. To ensure it keeps customer service up to snuff, Qwest examines its business plans to estimate the number of customers each of its business units will acquire in a given year. The company then calculates the funding those units will require for supporting the expected number of customers.

On top of that, Qwest worked with outside process experts last fall to formalize a four-phase product development process with detailed checklists to complete before moving from one phase to the next. "A lot of us have experience like the ISDN example," where groups such as customer service were left out of the product introduction process, Mohebbi says. Qwest's process fosters cooperation among groups with a supervisory team making sure they all mesh.

Such processes are no doubt important, but the real action in improving customer service is centered squarely on the Web.

Forrester Research, another market research firm in Cambridge, predicts 87% of the volume in customer support will be coming through Internet self-service by 2002, whereas the majority is by telephone today. You'd be hard pressed to find a vendor that won't say the Web is "critical," "crucial" or at least "very significant" to its customer service efforts (see sidebar, left).

"Today, about 86% of our business comes in via the Web," says Cisco's Schorsch. Cisco has reams of product data on its site, from bug fixes to sample configurations to technical tips.

Given all that data, finding exactly what you want can be a bit daunting. Dell Computer's answer is "Ask Dudley," a plain English search tool based on the Ask Jeeves search engine.

Ask Dudley is the entryway to a knowledge base Dell started building four or five years ago for its customer service technicians, says Manish Mehta, director of online support for the computer maker. To help solve the problems of customers calling in, Dell technicians accessed a database of troubleshooting information via the corporate intranet. This knowledge base increased in value as technicians entered more solutions to known problems.

In December 1998, the company essentially gave its customers direct access to that database, Mehta says. Dell conducted focus groups and surveys and determined that customers were willing to spend a few minutes searching for technical help online if they could ask questions. Ask Dudley lets them do just that, and in response presents a short list of relevant topics from the knowledge base.

"We're averaging well over 125,000 queries per week and growing," Mehta says.

However, he can't say whether Ask Dudley has reduced headcount in the company's phone support center. That's because there are too many

Continued on **page 109**

THE WEB IS ON THE RISE — WITH GOOD REASON

Channel	Cost per incident	Annual growth rate	% of incidents handled through these channels: Today	2002**
Telephone	$33	90%	54%	13%
E-mail	$9.99	111%	9%	4%
Chat*	$7.80	N/A	<1%	4%
Message boards*	$4.57	178%	<1%	2%
Knowledge base/Web	$1.17	407%	37%	87%

* Low penetration among firms reporting.

** Projected. Column adds to more than 100% because some customers will use multiple channels for the same incident.

SOURCE: FORRESTER RESEARCH, CAMBRIDGE, MASS

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Continued from page 106

other factors, such as ease-of-use features being built into PCs, to pin any such savings on one initiative. But Dudley has definitely helped Dell become more proactive in identifying problem areas.

Using a feature called Jeeves Insight, Dell can highlight the top customer questions that contain no content in the database. The tech support team then quickly creates that missing content.

MCI WorldCom is also interested in becoming more proactive, says David Nathos, director of frame relay product marketing. In the wake of that incident, the carrier determined that customer communication has to be No. 1, Nathos says.

In the future, MCI WorldCom will quickly post information regarding outages on its Web site. The carrier is also promising to notify customers within one hour if one of their frame relay links goes down for more than 10 minutes. That, at least, is a step in the right direction.

The promises come through the carrier's new Network Assurance program, which includes disaster recovery options and spells out actions MCI WorldCom will take in the event of an outage.

Additionally, the carrier has a Web-based application dubbed Interact that lets customers open trouble tickets and pay bills. Soon it will begin posting a sort of network quality report on its Web site that details information concerning software upgrades in the works, maintenance windows and other issues. That will be rolled out at the beginning of the second quarter.

Challenges ahead

While progress has been made, there's still a way to go when it comes to providing quality customer service via the Web.

Cisco will look to increase the level of personalization for its customers, with content specific to the customer's market segment and specific job, Schorsch says. "We'll probably see more wireless and multimedia solutions as well."

Like many, if not most, vendors, Cisco and Dell are working to better integrate various customer service channels. Ideally, if you send e-mail about a problem one day and place a phone call the next, the phone representative will know about the e-mail and all other related history.

"Bad customer service has a way of getting RID OF customers."

Cheryl Currid,
president of consultancy Currid & Co.

Qwest has support staffers answering customer queries via e-mail during certain hours, and lets larger customers send trouble reports via the Web. Consumer customers can deal with Qwest via the Web, from paying bills to reporting problems.

"The goal is to let anyone who wants to have a relationship with Qwest on the Web do so," Mohebbi says. That includes being able to check the status of your network online, something for which Qwest is finalizing plans, he says.

Anything that furthers the customer service cause is important, Giga's Pierce says. "I don't think anybody is really capitalizing on this huge opportunity," she says. "When someone does, I'll go work for them."

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Outlook 2000

WHAT'S POPPING IN THREE KEY MARKET SEGMENTS.

Having traveled just about one-third of the way into 2000, we've encountered a couple of real surprises on the enterprise networking path. The strategic shifts we've seen major network vendors — Cabletron, Lucent and 3Com — take away from the enterprise market had been unexpected indeed. We knew some things needed to change, but this? Of course, the hot infrastructure technologies will carry on, but vendor choices are diminishing.

Meanwhile, changes in the other two market segments we track — carrier services and enterprise applications — aren't nearly as dramatic. In fact, almost every player in these areas is still trying to determine where it fits into the hosted-application scheme. Take a look at how this year will shake out.

OUTLOOK: INFRASTRUCTURE

On a single day this past January, Cisco spent $567 million to buy not one, but two virtual private network (VPN) equipment makers.

The signal couldn't be clearer: Virtual private networking is going to be the hottest infrastructure growth area this year. Through the acquisitions, Cisco revealed that it is no longer banking on tying VPN technology to its routers exclusively. Now Cisco has remote-access enterprise VPN gear from Altiga Networks and carrier equipment from Compatible Systems.

In the short term, VPN vendors will benefit from Cisco's moves. "Everybody's going to make some money in 2000," says Jeff Wilson, an analyst at Infonetics Research in San Jose.

Makers of free-standing VPN devices will complete more sales because they won't face the powerful Cisco mantra that states free-standing gear is the wrong way to go, Wilson says. Look for vendors such as Check Point Software, Indus River, Sonic Wall and Watchguard to clean up, he adds.

The money is there. Enterprise users will plunk down nearly $300 million more this year for VPN equipment than they did last year, an increase of 65%, says IDC in Framingham, Mass. They'll use this equipment to build remote access and site-to-site VPNs for corporate employees only.

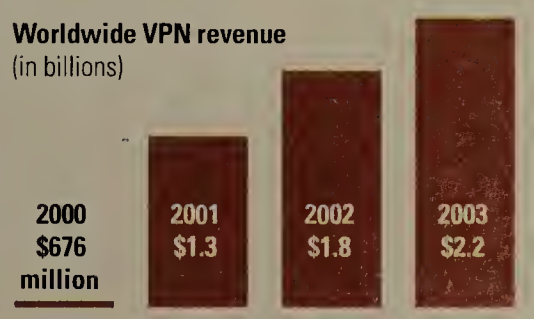
With the momentum begun this year, by 2002 VPN spending will increase to more than $700 million per year, IDC says. Expect to see an uptick in VPN services this year as vendors ready for that splurge. These services will blend VPN technology into WANs. Likewise, VPNs and firewalls will become firmly tied together by the start of next year. And VPNs will become integrated with public-key infrastructures for establishing user identities and determining encryption keys.

Vendors also expect that VPN capability in Microsoft's Windows 2000 will boost overall demand — if for no other reason than the client software will be so widely available.

Second to VPNs, this will be the year that Gigabit Ethernet and Layer 3 switches march into the enterprise. "Gigabit Ethernet will finally live up to its billing in 2000," says Lauri Vickers, an analyst with Cahners In-Stat Group in Scottsdale, Ariz. In both areas, expect to see Extreme Networks emerge as a bigger player.

VPNs TAKE FLIGHT

Revenue for stand-alone virtual private network equipment is projected to increase steadily this year and beyond.



SOURCE INFONETICS RESEARCH, SAN JOSE

A key new driver this year will be Gigabit Ethernet over copper, which started shipping at the end of 1999. Gigabit Ethernet over copper is attractive because it runs over existing Category 5 wiring and costs one-third less per port than Gigabit Ethernet over fiber.

In 1999, Cisco led the Gigabit Ethernet pack with 39% of market revenue, In-Stat says. 3Com came in at a distant second, with 13% of revenue. That latter figure includes revenue 3Com earned from the Extreme Networks switches it resold.

Of course, 3Com has left the race and, as part of its exit strategy, is referring CoreBuilder customers to Extreme. While its unclear how much Extreme will benefit from that move, it's relatively certain that the vendor will at least get looked at by new enterprise prospects. In fact, all smaller players, including Alteon WebSystems and Foundry Networks, should fare well from the Gigabit Ethernet boom.

When it comes to Layer 3 switching, Cisco will continue to pull in the most sales, followed by Cabletron and then Extreme, according to In-Stat. With Cabletron's recent four-way split, continued growth in enterprise networking now falls under the unproven Enterasys Networks banner. "The best way I can think of describing it is as a well-positioned wild card," Vickers says.

Here, too, Extreme is positioned to pick up customers reluctant to go with the Cabletron spinoff.

In all, vendors sold $1.8 billion in Gigabit Ethernet switches last year and will sell $4.3 billion this year, In-Stat projects. For Layer 3 switches, sales were $2.6 billion in 1999 and are projected to be $5.3 billion in 2000. Meanwhile, Layer 2 switches still account for 79% of LAN switch purchases, In-Stat says.

The upshot: The drive for speed in the enterprise as well as the expanded use of VPNs will be key sources of revenue growth for network vendors this year.

— Tim Greene

SAYING GOODBYE TO THE ENTERPRISE

Once big-name enterprise infrastructure players are moving away from this market.

3Com

On March 20, 3Com announced that it's exiting the enterprise network market. Toward that end, it will:

- Ship the last CoreBuilder Layer 2 and Layer 3 Gigabit Ethernet and ATM LAN switches as well as PathBuilder and NetBuilder WAN switches and routers on June 30.
- Expand its relationship with Extreme Networks and migrate CoreBuilder customers to that vendor's platforms.
- Transition PathBuilder and NetBuilder customers to Motorola products.
- Service and support customers of all dropped products for up to five years.

Lucent

On March 1, Lucent announced a restructuring. Per the plan:

- The business cabling, LAN products and PBX lines will be spun out into a separate company that's yet to be named.
- The WAN Systems Group, which includes WAN edge devices acquired with Ascend and Xedia, remains with Lucent.

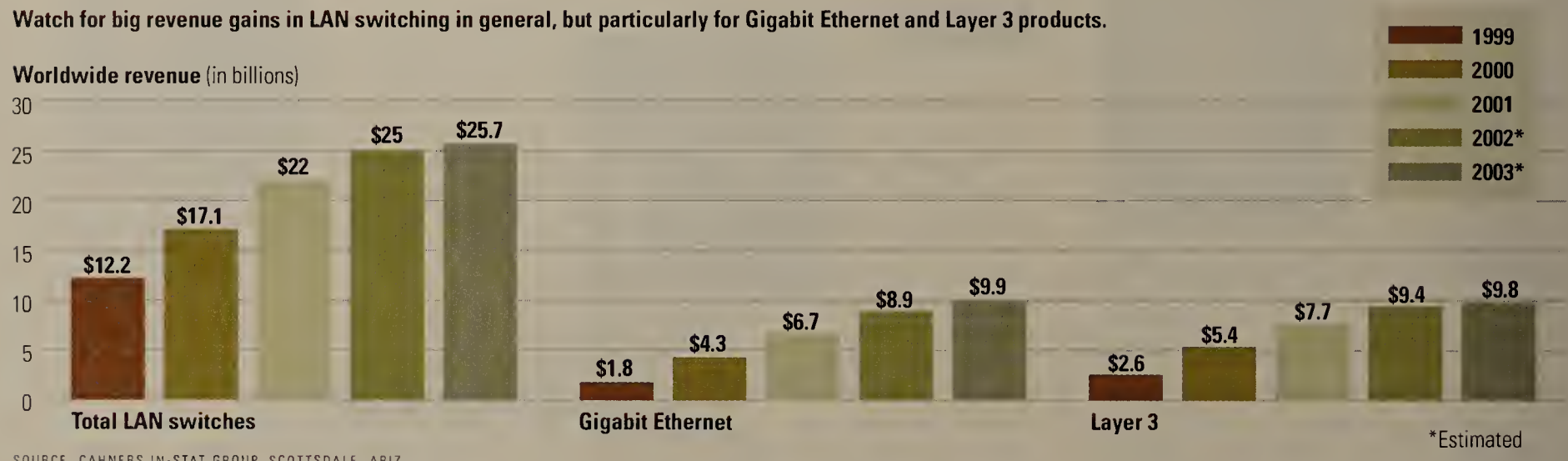
Cabletron

On Feb. 10, Cabletron announced its breakup into four independent operating companies. Serving enterprise customers will be:

- Enterasys Networks, providing infrastructure products.
- Global Network Technology Services, providing network consulting services.
- Aprisma Management Technologies, providing infrastructure management products.

SWITCHING INFRASTRUCTURES

Watch for big revenue gains in LAN switching in general, but particularly for Gigabit Ethernet and Layer 3 products.



SOURCE CAHNERS IN-STAT GROUP, SCOTTSDALE, ARIZ.

OUTLOOK: CARRIERS & ISPs

When the all-IP national broadband carrier Level 3 Communications burst onto the scene a couple of years ago, it dreamed of busting up the AT&T/MCI WorldCom/Sprint long-distance cartel. For nearly a year and a half, Level 3 executives from CEO James Crowe down banged the drums, beating out the message for enterprise users that its long-distance voice-over-IP service would smash per-minute tolls to bits.

But when the service was finally introduced last December, it caused barely a whimper among enterprise users. Why? Simple: If you run a corporate network, you can't buy it. Like almost everything else from Level 3, the service is for carriers.

Level 3's transformation from an enterprise network voice and data service provider in 1998 to a wholesale bandwidth vendor in 2000 is

ONE AGAINST THE OTHER

The idea of hosted application services is all the rage, but the revenue opportunity remains small compared with competitive local exchange carrier and long-distance services.

* Estimated

SOURCE FCC, WASHINGTON, D.C., NEW PARADIGM RESOURCES GROUP, CHICAGO, THE YANKEE GROUP, BOSTON

emblematic of what's happening in the carrier marketplace. More than 600 long-distance carriers operate in the U.S. today, yet many don't court enterprise customers. This trend will become the defining characteristic of the carrier and ISP marketplace by year-end.

The pattern is already clear. While dozens of carriers start up every month in the U.S. and Western Europe, many are little more than shells — often started with junk bonds and headed by a few former MCI WorldCom guys. These carriers get into the action by renting everything from bandwidth to simple applications.

The competitive local exchange carrier (CLEC) industry is booming, too, having grown 152% last year to $23.6 billion, according to New Paradigm Resources Group (NPRG) in Chicago. But many CLECs offer little more than alternative dial tone and T-1s — NPRG says 60% of CLEC revenue is voice-related — and many cater to small and midsize businesses.

In fact, the raw statistics mask the fact that most carriers and ISPs do only a few things well: Concentration and core competencies remain the orders of the day.

CLEC SWEEP

New Paradigm Resources Group, a market research firm in Chicago, forecasts a 215% growth in the CLEC market from 1999 to 2001. The outcome for CLECs:

- Positive cash flow and profitability.
- Heightened consolidation.
- Expansion of next-generation services.
- Acceleration of technology deployment to handle IP and other data traffic.

That's one reason no one's sure which of the many application service providers (ASP) will meet with success this year.

Almost every major carrier has announced an ASP strategy or at least a partnership that purports to provide a strategy. Yet the market for pure applications hosting is growing relatively slowly (or only moderately) — from $1.1 billion in 1999 to an estimated $1.7 billion this year and $2.4 billion in 2001, according to The Yankee Group in Boston. Analysts say the market for real applications management belongs to a handful of specialized providers, particularly Corio, Interliant and USinternetworking. Much the same can be said for the Web-hosting business, dominated by ISPs that have branched out — such as MCI WorldCom's UUNET and Frontier's GlobalCenter — and a few independents like Exodus Communications.

AT&T's struggle to play in these new areas is particularly telling of how only a few will remain in the hosting and ASP businesses, for the long and short haul. One of the longtime major clients for AT&T's outsourcing unit, AT&T Solutions, is Merrill Lynch. So when Merrill Lynch decided to enter the online brokerage business last year, it looked at AT&T's plan to build 26 Web-hosting centers. Problem was, it was just that — a plan — and AT&T had barely begun building its New York hosting facility. So Merrill Lynch chose Exodus instead — and then smoothed out ruffled feathers by announcing that AT&T Solutions, Exodus and Merrill had entered into a three-way "partnership" for the firm's online venture.

It's the same story in the ASP space, where AT&T announced partnerships with no fewer than 17 server, application and operating system vendors before finally forging an alliance in February with the evident ASP leader, USi, to go to market. And until AT&T finishes building its Web-hosting centers — many of which are really converted central offices and aren't expected to come online until late this year or early next — we don't know whether AT&T will be a strong ASP contender.

Of course, only a few companies will

Continued on **page 115**

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Continued from page 113

succeed in busting up carrier markets at all. The outstanding example to date is Qwest Communications, which despite its public marketing is practically an "all things to all people" carrier: voice over circuit switching or IP to consumers or businesses, data over frame relay, ATM or Internet, and pure transport or applications hosting.

The reason more won't follow in Qwest's footsteps in 2000 is the tough ride the carrier had last year, and this year already promises more of the same. In 1999, it struggled against user reports of months-long circuit order delays, an acknowledged shortage of electronic equipment and slamming accusations from the Federal Communications Commission. This year, it's faced the resignation of Solomon Trujillo, CEO of merger partner US WEST, in open disagreement with Qwest CEO Joe Nacchio.

The regional Bell operating companies haven't given up the cause and will continue to fight hard in 2000. But so far, only New York allows the Bell there — Bell Atlantic — to sell long-distance voice and data services. By year-end, look for more than a half-dozen states to give the long-distance nod to Bells. Then again, if Bell Atlantic's actions serve as the precedent, don't expect much competition to revolutionize the market. Bell Atlantic offers only a 10-cent-per-minute calling plan.

The upshot: Setting up a national carrier that has a complete business-user, customer-service structure will continue to be hard work.

— David Rohde

OUTLOOK:

ENTERPRISE APPLICATIONS

It wasn't so long ago that PeopleSoft's new plan to offer a service that lets customers rent applications, rather than license them outright, would have sounded like corporate suicide. But as they say, the Web changes everything.

"Our upcoming PeopleSoft release 8.0 will have a 100% HTML user interface. We've done away with the Microsoft Windows client," says Andy Allbricten, vice president for PeopleSoft's recently announced eCenter. The center hosts the company's applications and lets business customers access them, for a monthly fee, from any Web browser.

The Web has been driving the software industry to transform enterprise applications into browser-accessible services. This year, all the major business software vendors will adopt that form. And in three to five years, software-as-a-service will become an accepted way to outfit an enterprise with applications.

Application service providers (ASP) expect to make a killing. PeopleSoft executives predict that within three years eCenter hosting will account for 50% of license revenue. Oracle Chairman Larry Ellison predicts a majority of license revenue will come from this ASP model

Continued on **page 117**

PACKAGED SOFTWARE

Where we'll end the year.

Worldwide packaged software revenue* (in billions)

* For all shrink-wrapped software, including PC applications. See graphic, next page, for application segments.

SOURCE IDC, FRAMINGHAM, MASS.

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Continued from page 115

within five years.

Overall, IDC projects the market for software applications and attendant services will hit $70 billion this year. By 2004, the market will soar to more than $300 billion. About $150 billion of the larger figure is for the software itself, the rest for consulting, maintenance and similar services.

But enterprises won't have to wait that long to reap the benefits. In 2000, because of the Web browser and the move to server-based computing, business applications will become more affordable, faster to deploy and easier to use than ever before. They will also become more "interrelated."

The vendors offering the most value will be those with an architecture that lets service providers incorporate other applications, and juggle data and business processes across different organizations linked via an extranet.

Throughout this year, enterprise users will see more attempts by independent software vendors and ASPs to create in partnership interrelated applications. "The vendors are tying into collaboration and workflow engines," says Dennis Byron, IDC's research director for enterprise applications. "Some industries, like architecture/construction, need a lot of collaboration for projects. With an ASP model, they don't have to create the infrastructure for this themselves."

Also in 2000, as these hosted services become more widespread, wireless devices will be created to access them, says Mark Gorenberg, a partner with Hummer Winblad Venture Partners, a San Francisco venture fund specializing in software. In many industries, he says, business managers are starting to realize that wireless access to Web-based business data creates real-time interactivity. "There's a growing expectation that people can and should respond at once on mission-critical applications running on extranets and intranets," he says.

That realization will hit home this year with more companies writing applications that enable handheld devices to read and update Web-accessible data and line-of-business applications.

The upshot: Applications hosting will lower costs for enterprises while spurring demand for interrelated applications and wireless data access.

— John Cox

APPS OPPORTUNITIES

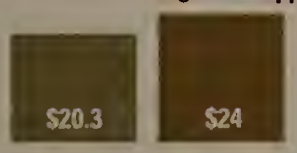
Enterprise application vendors will see revenue climb in key e-business segments.

Worldwide revenue (in billions)

Total software applications

Customer relationship management applications

Enterprise resource management applications



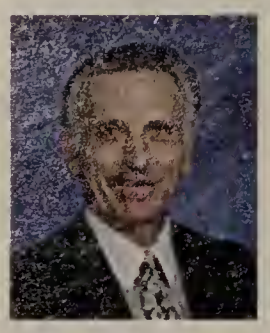
E-commerce software

1999 2000*

*Estimated

SOURCE IDC, FRAMINGHAM, MASS.

NetworkWorld 200
EXECUTIVE PROFILES



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Signature Sign Off

The Network World 200 Index

WE TEAM WITH FINANCIAL SITE THE MOTLEY FOOL TO DELIVER NETWORK COMPANY STOCK UPDATES, PROVIDE COMMUNITY DISCUSSIONS.

By Beth Schultz

The Network World 200 is a great tool for assessing the financial well-being of top vendors in this business. Not only does it lay out which network vendors have the highest revenue, but also which ones are the most profitable, fastest growing, biggest R&D spenders, highest valued, and which have the highest revenue per employee. Still, the NW200 omits one critical measure: stock performance.

The NW200 tells us that IBM rules the network roost, taking the No. 1 spot in our ranking once again. It doesn't tell us that Big Blue's share price has been holding relatively steady for years, but swung in the last 12 months from a low of $90.25 on Nov. 5, 1999, to a high of $246 on May 5, 1999, with a 2:1 split May 27. Or that NW200 newcomer Foundry Networks, No. 133, has been in big play on Nasdaq. In these early months of 2000, we've seen Foundry's share price reach as high as $345, on Jan. 3, and dip as low as $78.06, on April 13, after splitting 2:1 on Jan. 10.

So *Network World* has teamed with online investment education firm The Motley Fool to launch an NW200-based stock index. We've taken our list of the top 200 companies in networking, assigned each a weight based on its 1999 revenue and created a tool you can use to track stock performance. Using the Network World 200 Index, you can track performance of network companies individually or as a group. Because of the weighting, larger revenue companies will affect the index more than smaller ones.

A simple index view shows share price, updated every 15 to 20 minutes, plus dollar and percentage changes, high and low prices, and volume. A detailed view provides additional trending information, and, with The Motley Fool's help, you'll be able to determine when fluctuations are serious and when they aren't.

Consider, if you would, the NW200 Index as the network equivalent of the Standard & Poor's 500 — the leading stock index of companies across 24 distinct industries, from aerospace and defense to utilities. NW200 companies represent just one-tenth of the S&P 500 makeup, and are lumped not together but in three distinct industry segments. Smaller, but hotshot NW200 companies like Covad Communications, Exodus Communications, Extreme Networks and Foundry aren't represented on the S&P 500.

With the NW200 Index, you immediately get a snapshot of how the network industry is faring on the wild exchange rides. If you had been tracking it a week ago, you would have seen it drop from its opening of $200 into the mid $170s, coming to a close April 17 at $175.28. Over time, the NW200 Index will provide a historical view, helping you judge individual companies and the health of the industry. This in turn will become a tool for comparing our industry with other vertical market segments, as well as directly against companies represented in the Nasdaq and Dow Jones indexes.

But the straight numbers are only part of the picture. We'll link you to information *Network World* has gathered and stories we've published on NW200 companies, and then you can ask your own questions through The Motley Fool's online investor community. The Motley Fool is setting up a message board expressly for this purpose, and *Network World* editors will actively participate. "An index like the NW200 should provide seed material for community-based discussion and knowledge exchange," says Kevin Book, director of Web development for The Motley Fool site, www.fool.com.

Foundering stock prices could indicate a company is going to face some serious financial problems. But maybe the tumble is an anomaly, and other signs indicate the stock will shoot back up. Before you sign that network contract, you might want to solicit the opinion of seasoned investors.

"Hopefully, the NW200 will bring a few new tech-savvy Fools to the fold for the mutual gain of all within our community," Book says.

Of course, *Network World* readers won't be limited to participating in the NW200 Index message board. The Motley Fool would love to serve as a general information source and knowledge base for any investment questions you might have. More than two million users visit www.fool.com monthly, and hundreds, if not thousands, post tech-related stock messages daily, Book says.

So head to our special NW200 Fusion minisite, at www.nwfusion.com/nw200/2000 and start checking those network stocks. And, if you're so inclined, jump into a Motley Fool discussion on network vendors. ◪

ON LINE

TRACKING THE NW200. How are the NW200 companies faring on Wall Street? Find out with our up to the minute stock index.

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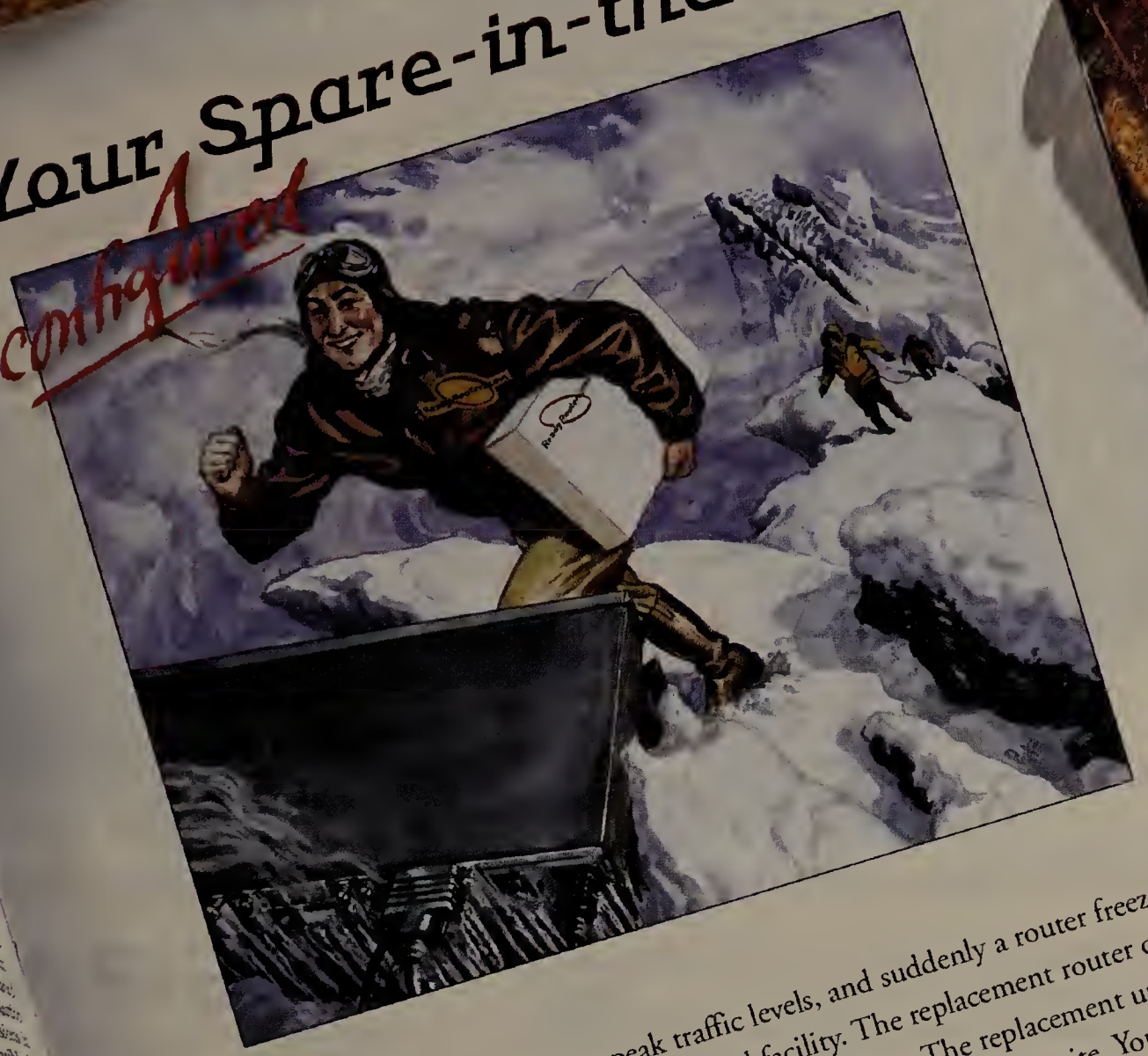

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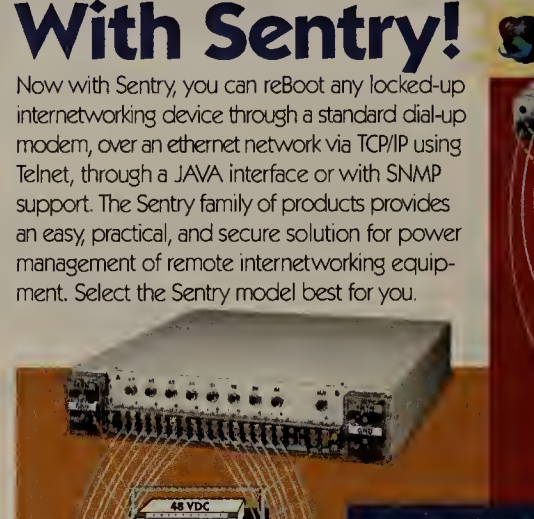

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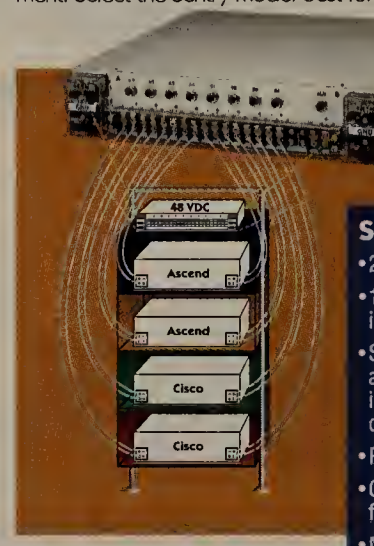

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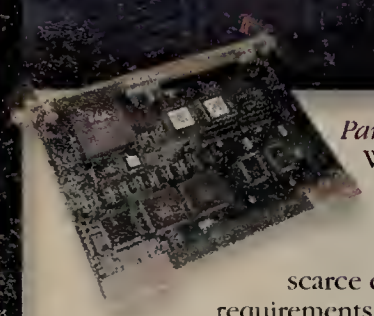

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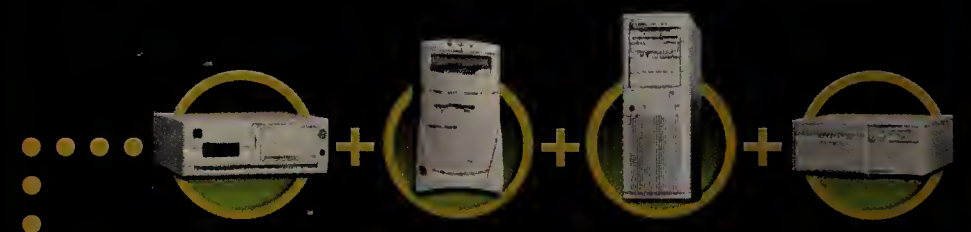

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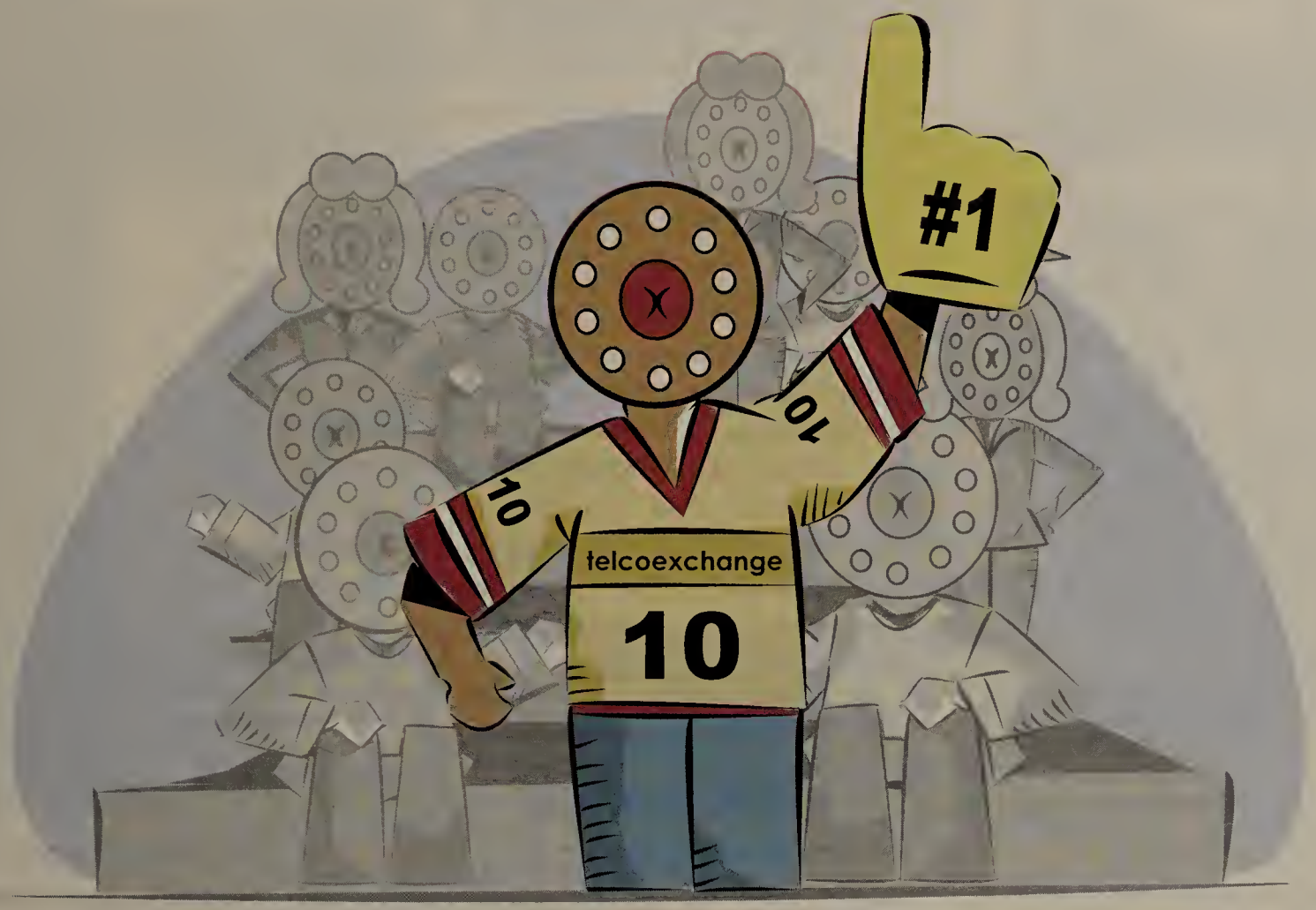

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A New KVM Switch Index

Tron launched a completely revamped web site to include the most detailed and comprehensive index of keyboard, monitor, mouse switches, with extension and sharing devices available anywhere. The index currently includes products from fourteen manufacturers listed into more than a dozen categories to guide the user directly to the type of product under review. Once inside a specific category, the user can compare all of the available products from one menu.

KVMS Technology Seminar

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The Industry Standard

Keyboard/Video & Mouse Switch Technology White Paper

All New 2000 Revision

This document has been completely revised and updated to include an extensive review of the industry's multi-console KVMS Systems that will support the entire data center with distributed console access. In addition, we included a detailed look at the Category 5 Extension Technology that makes the interconnection between the hardware components of these large KVMS Systems. And, we updated the original material to provide you with the latest changes affecting the technology today.

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To easily understand the potential of direct remote access to the keyboard, monitor and mouse of your workstations and servers, consider your current network infrastructure. It consist of clients, servers, network hubs and the cabling backbone. An enterprise-sized KVMS System is comprised of a similar set of components consisting of two end pieces, a middle piece, and the cabling in between. The KVM Network™ simply defines the transmission of a different data set comprised of electrical data signals that control the computer system, in contrast to a standard network where data is being stored or moved between computers.

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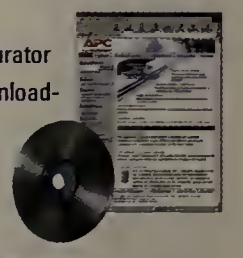

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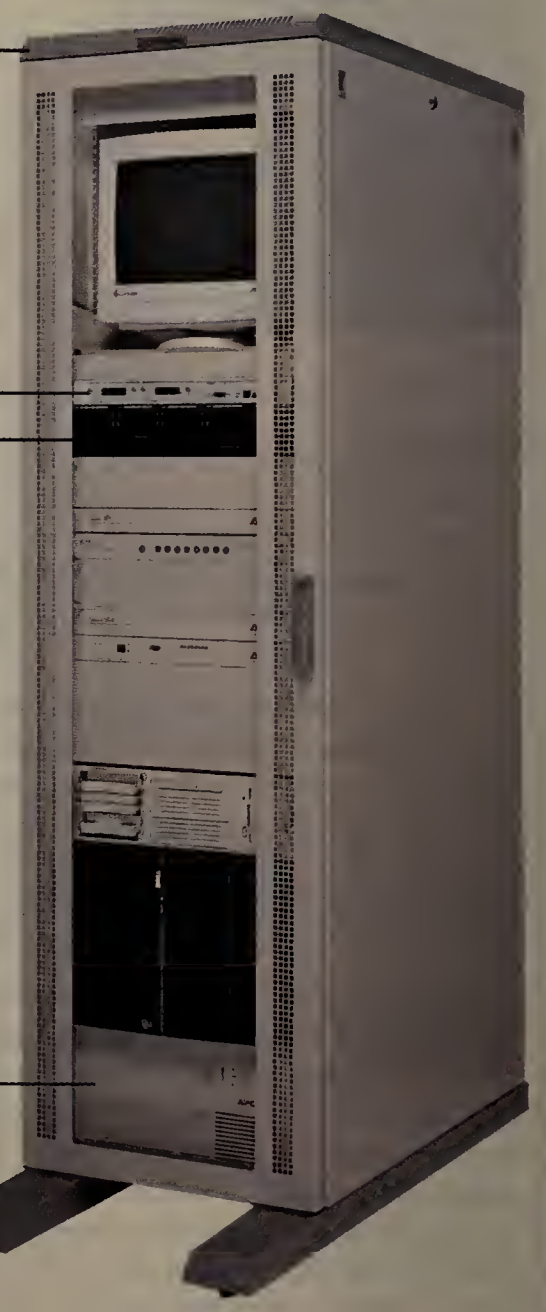

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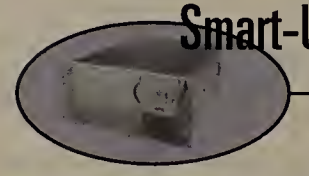

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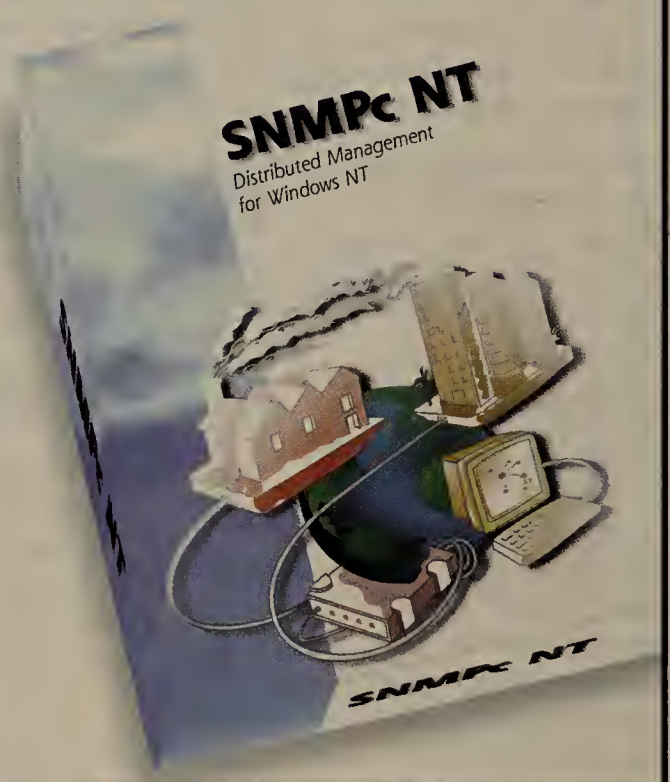

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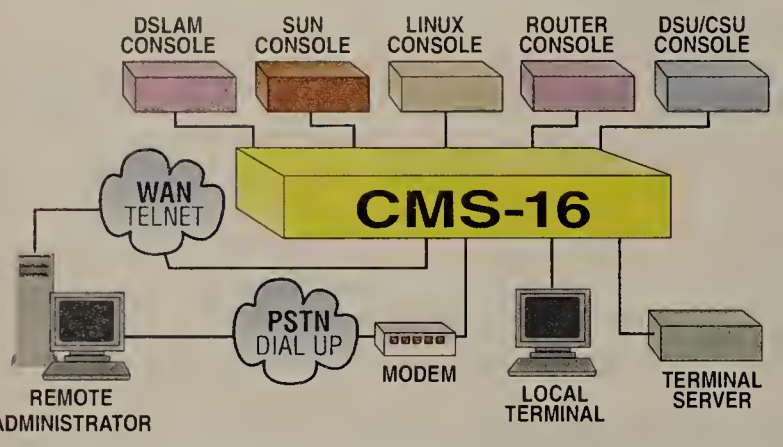

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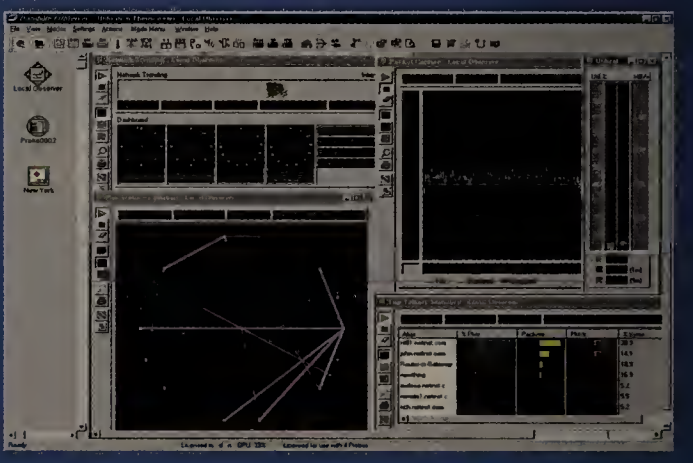
Observer identifies network trouble spots, and costs thousands less than expensive hardware-based analyzers. If you have network slowdowns would you know if they are being caused by packet errors, broadcast storms or overloaded utilization? Find out with Observer or Distributed Observer.

Observer's Extensions add to the functionality of Observer and Distributed Observer by providing SNMP object tracking, WEB browser based reporting, RMON1/2 Probe monitoring and Expert mode post-capture analysis - all within the Observer interface. Network Instruments' Probes are also available as RMON1/2 Probes for $295/each.



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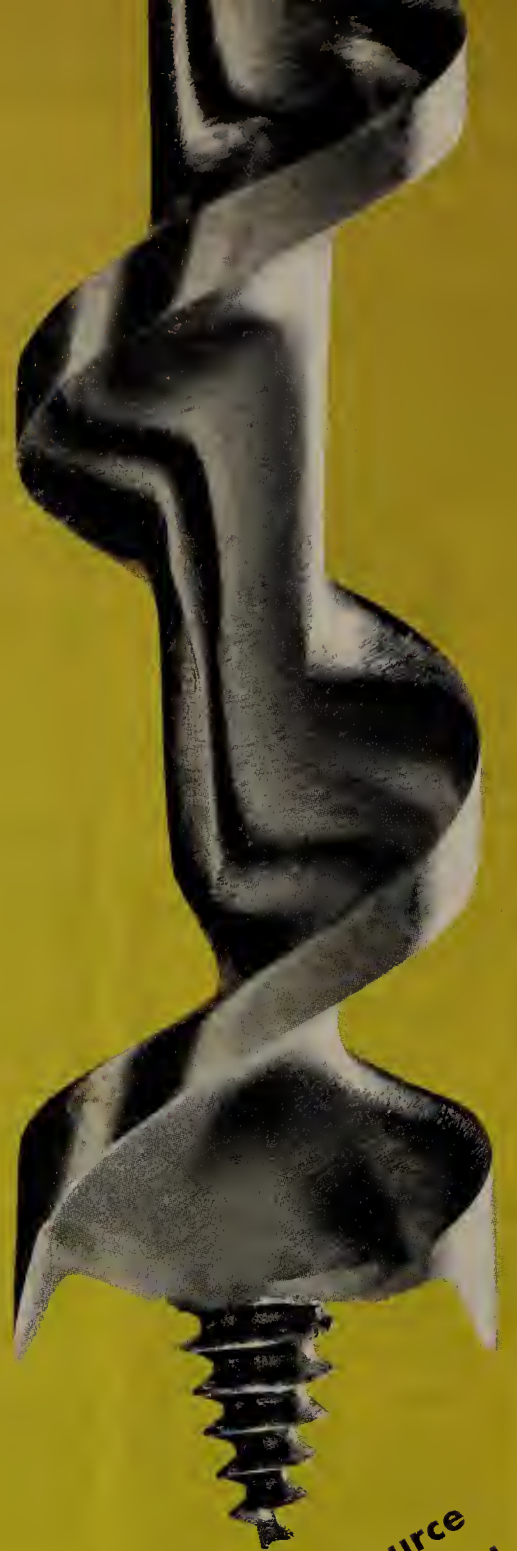
Tests/Reviews in May

Issue	
May 1	• DNS/DHCP servers.
May 8	• Biometric authentication suites. • Switch Metric Round 3. • ZenWorks for servers. • Phobos load balancing switch.
May 15	• LDAP servers and server market overview. • NetScout WebCast. • Cryptography accelerators. • Cisco routers.
May 22	• Compaq cluster server review. • Application performance management.
May 29	• ADS vs. NDS, hype vs. reality. • Novell clustering.

Please nate that technology updotes, and comporotive ond single product review dotes ond topics ore subject to change without natice.



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Job # WEB 92224-IT Consultant--Develops software systems, applying computer science, engineering and mathematical analysis using : application analysis, design and development, Oracle, DOS Windows 95, Windows NT, Unix, SOL, PL/SOL, C and Pascal. Analyzes software requirements and performs testing and user training after development. Work involves extensive travel and frequent relocation. Must have 1 1/2 years experience as a computer professional with Oracle, PL/SOL, Visual Basic and Access. Must have Master's degree in one of several limted fields: engineering, mathematics, computer applications or physics. 40 hrs/wk, 9am-5pm, M-F. $65,500/yr. Submit resume referencing above job # to Washinton Job Center Manager, Millcraft Center, Ste 150-LL, 90 West Chestnut St. Washington, PA 15301-4517

Full time Bios Engineer responsible for the design and development of IBM PC/AT compatible BIOS using Intel 80x86 assembly language. Develop the BIOS for different motherboard chipsets initialize memory controller, cache controller, various I/O and Super I/O controllers, PIC and I/O APIC controllers, DMA controllers, ISA/EISA/PCI bus controllers and bridges. Develop software tools for testing and debugging BIOS on different OS. The testing of each module of BIOS, compatibility testing and bug fixing. Must have a Bachelor's Degree in Computer Science, Electronics Engineering, or related field (foreign degree equivalent accepted). Must have two years of experience in the job offered or two years of experience in a position with same duties. Salary: $58,234/yr. Send resume to: Nanda Chhda, American Megartrends, Inc., 6145-F Northbelt Parkway, Norcross, Georgia 30071.

PRINCIPAL ARCHITECT/PROJECT LEADER:Responsible for research into language conversions, database, migrations, operating system migration and the identification and remediation of programming errors concerning the year 2000 (Y2K) problem. Organize and manage a development team in the execution of appropriate solutions. Research activities include identifying problems in system level software and categorizing potential errors related to particular programming languages and environments, developing generalized solutions. and cataloging problems, approaches, and methods to be applied to industry software systems. Requires: M.S. in Computer Science or related fields and 4 years experience in software development. Knowledge of distributed systems based on client/server model. Skills in UNIX, Microsoft Windows NT, Windows 3.1/95, C/C++, FORTRAN and RDBMS including Oracle. 40 hrs/wk (9 to 5); $110,000/yr. Send two resumes/response to Case #19992076, Box 8968, Boston, MA 02114.

PROGRAMMER/ANALYST to provide on-site consulting to analyze, design and develope Web solutions to business requirements ranging from e-commerce to proprietary Intranets using object oriented programming languages and methodologics such as Java, C++, UML and architectures such as Servlets, CORBA and COM; perform data base connectivity to various databases, web solution hosting and site management, internationalization and user interface creation for web-based systems; use relational databases such as Oracle, SQL Server and DB2. Require Bachelors in Electronics Engineering/Computer Science and two years experience in the job offered or as Programmer. 40% travel to client sites within the United States required. Salary: $64,000 per year, 8 am to 5 pm, M-F. Send resume to: H.R. Manager, 4C Solutions, Inc., 4601 Six Forks Road, Suite 500, Raleigh, NC 27609.

Principal Software Engineer: Develop computer programming directed at implementing and developing Riposte, a proprietary technology for use in Postal Authorities and other semi state entities. Consult with Engineering staff to evaluate interface between hardware and software. Responsibilities will involve incorporating transaction security measures and real time transmission of instructions and current account information. BS or equivalent in CS or related field 5 years exp. in job offered or related field such as Software development Experience must include Five years exp. pre or post degree in software development two years of which are in developing financial software for postal clients. Such exp. must include C++, Visual Basic, Com. developing under windows NT. Must be willing to travel to various client sites 40 hours/wk 9 a.m.-5p.m.-$ 80,000-$ 115,000 per year. Applicants should send resume in duplicate to Case # 19991195 PO Box 8968, Boston, MA 02114

Senior Software Engineer responsible for design, development, coding & quality testing of client/server applications software interfacing with the back-end servers. Responsible for software application deployment, on-site implementation, customization, & training of specific software products. Also responsible for design & implementation of internet web-based applications. Requirements include: MS in Engin or CS & 3 yrs. experience in job offered or 3 yrs developing database applications in UNIX OR BSc in Engin or CS & 5 yrs experience in job offered or 5 yrs developing database applications in UNIX. Candidate must also possess demonstrated expertise in database performance analysis & optimization tuning; demonstrated expertise in UNIX shell programming using AWK or Perl; & demonstrated expertise validating data for conformance to EDI standards. Sal: $77k/yr; 9am-5pm. Send 2 resumes to: Case No. 19990220, MA. P.O. Box 8968, Boston, MA 02114. EOE. Applicants must be US workers eligible to accept full-time employment in US.

Software Engineer-Design, develop, and document software products which meet the Company's standards of performance, functionality, reliability and marketability. Develop conceptual framework for software products and enhancements. Design software features and products. Direct and review the work of other less senior developers and engineers as needed. Write source code and debug software components. Write internal and external documentation for software. Provide high-level technical expertise to other departments in order to support software products. Provide technical customer support and consultation service related to product installation and application. Fix highly complex software problems reported by customers which have been referred by the company's support staff. Requirements include a Master of Science Degree in Mathematics or related field and no work experience or a Bachelor of Science Degree and three years of experience in Software Engineering. Candidates must pass programming and technical aptitude test. Applicants must have unrestricted authorization to work in the United States. Salary $89,000/year. 40 hours/wk. Respond with two copies of resume to Case #19990505, P.O. Box 8968, Boston, MA 02114.

Software Engineer: Analyze, design, develop, test, debug, deploy, and production support of a System using ORACLE REBMS (V 7.0/V8.0) in a client server environment running under HP (HP-UX) using TCP/IP network protocol. Develop client side application modules and back end server processes using various ORACLE and development tools such as ORACLE FORMS Versions 4.5/4.0/3.0 REPORTS Version 2.5/2.0/1.1, SOL*plus, PL/SOL, SOL*LOADER, PRO*C, SOL*NET, 'C' language on various operating systems like UNIX OS (SCO-UNIX, SUN-UNIX, HP-UNIX) MS-WINDOWS NT/95. Install and configure ORACLE databases, development tools and other required hardware and software, perform coding, component testing, system testing documentation, end user training, maintenance and support. Must be willing to travel and relocate as required. Several positions available. Req'd: Master's Degree or equivalent in Computer Science or Math or related field and 3 years experience in the job offered or in a related occupation-Programmer. 40 hours/week-8a.m. to 5p.m. $76,252.80 per year and $33.65/hour overtime as required. Send 2 copies of resume to Case #19990143, P.O. Box #8968, Boston, MA 02114.

MBNA Hallmark Information Services, a subsidiary of a major national bank, is actively interviewing for a limited number of openings in its Distributed Operations department in Newark, Delaware.

SENIOR SOFTWARE ENGINEER

Must have a bachelor's degree in computer science/engineering and five years of progressive experience as a Senior Software Engineer or five years of progressive experience in a software design/development occupation. Must have experience with Windows NT, SYBASE, SQL, PowerBuilder and Tuxedo.

Competitive salary and benefits package offered. Send resume, reference code no.N130010106, to MBNA 1100 N. King St., Wilmington, DE 19884-2233.

Lead a team of software engineers in the design, development, and customization of application software projects using a combination of INFORMIX, 4GL, ESQL-C in a UNIX environment. Requirements: Master's degree in Cmptr Sc., Math, Elctrcl Engng, Mech Engng, Physics or related field. Two years job offered or 2 years experience as a software engineer, programmer, analyst or related tech. occ. Related occupation experience must include two years combined experience in the design, development and customization of application software projects using a combination of INFORMIX, 4GL, ESQL-C in UNIX environment. Salary: $83,699.20, 8am-5pm, 40 yrs/wk, M-F. Applicants should respond to Case #19983060, PO Box 8968, Boston, MA 02114. Applicants should submit two copies of his/her resume in response.

Sr. Software Engineer. Lead a software development team in the logical and physical system design, development, implementation and testing of various software design and development projects including Sybase Database Administration using Sybase SOL Server, Sybase Transact SOL, PowerBuilder, ERWIN, and C in UNIX and Windows environments. Requirements: Master's degree in Cmptr Sc. Elctrcl Engng, Math or related field. Two years experience in related occupation as a Software Eng., or Programmer, or Analyst, or related occ. Related occupation experience must include at least 1 yr. exp in the design, development, implementation & testing of various projects including Sybase Database Admin. Using Sybase SQL Server, Sybase Transact SOL, PowerBuilder, ERWIN, and C in UNIX and Windows environments. Salary: $75,000, 8am-5pm, 40hrs/wk, M-F. Applicants should respond to Case #19991448, PO Box 8968, Boston, MA 02114. Applicants should submit 2 copies of his/her resume in response.

Senior Network Engineer to design, implement & maintain all aspects of data networking systems & functions. Design etherswitches & routers; perform network punch-downs, wiring & labeling; and design firewall configurations. Use Ethernet, FDDI & ATM networks. Perform systems administration on UNIX servers; design network according to business requirements; implement and analyze networking technologies including ATM, Gigabit & fast Ethernet. Also manage corporate DNS structure. Requires B.Sc. in CS, EE or Math plus 2 yrs experience in job offered or 2 yrs exper in network engineering. Candidate must also possess 1 year's experience in each of the following skills: demonstrated expertise performing network configuration, including routing protocols and access control lists, using CISCO Routers; demonstrated expertise in network implementation using Ethernet, Fast Ethernet, ATM or FDDI networks & demonstrated expertise performing domain name system configuration & maintenance. Sal: $72,500/yr; M-F, 9A-5P. Send 2 resumes to Case #: 19990007, PO BOX 8968, Boston, MA 02114. EOE. Applicants must be U.S. workers eligible to accept full-time employment in U.S.

BOSE Corporation, an innovative leader in consumer electronics and acoustics, has an immediate need to fill a range of SAP, EDI and Sales Systems Support positions in the Boston area.
The following positions all require a Bachelor's degree (or equivalent) in Computer Science, MIS, Business Administration, or similarly relevant field, and 2-6 years relevant experience to include the requirements described below.
PROGRAMMER-ANALYST POSITIONS
•Sap Basis Administrators (with SAP experience, involving both Oracle and HP-UX and protocols, in a production environment.)
•EDI- Sales Systems Support Programmer/Analyst (with EDI mapping and HP-UX scripting experience, in a production environment.)
Starting salaries range from $47,100 to $82,600 per year, together with two weeks annual paid vacation, medical and life insurances, and other industry-competitive benefits.
Please mail or fax your resume to: Mr. Donald Baptiste, (IMSP), Bose Corporation, Dept. 5-D-1, The Mountain, Framingham, MA 01701. Fax (508) 766-7499. Email: don.baptiste@bose.com. Visit: www.bose.com

SOFTWARE ENGINEER to provide on-site consulting to determine user requirements, deveop specifications; analyze, design, develop, test and implement applications software using Visual Basic, Crystal Reports and DBMS such as SOL Server, Oracle and MS-Access in Windows and UNIX; formulate steps for program development using structured analysis and design; convert specifications for coding and link VB applicatons to external applications such as MS-Word and Excel. Require: Bachelors in Computer Science or Engineering and two years experience in the job offered or any experience providing skills in described duties. 40% travel to client sites within the United States required. Salary: $69,000 per year, 8 am to 5 pm,M-F. Send resume to : Human Resource Manager, 4C Solutions, Inc. 4601 Six Forks Road, Suite 500, Raleigh, NC 27609.

Unicom, Inc. is a professional software consulting firm providing services throughout the United States. We are seeking to fill multiple full-time positions for Software Engineers to design, develop, plan and test computer programs. Software Engineer positions require a minimum of a Bachelor of Science in Comp. Sci., eng. rel. field or equiv., and 1-5 years of experience (depending on position) in one or more of the following skills:

Databases
Oracle, Developer 2000, SOL, Powerbuilder, Informix

Mainframes
CICS, Cobol

Languages & environments
C, Java, C++, Visual Basic, Visual C++, IMS, Object Views, Unix, Windows.

Please mail resume to: Human Resources, Unicom, Inc., 2 Lucy French Way, Ashland, MA 01721, or fax to: (508) 881-2410.

Software Engineer to analyze, design, develop, test and implement Windows-based property management systems using object oriented design and programming techniques, component-based programming, Delphi, Visual Basic, relational database and X-based files; direct and participate in all phases of software development by providing high-level functional ADP systems analysis, design, integration, documentation and implementation on Windows 95/NT, DOS and UNIX operating systems with programming tools FoxPro, Visual FoxPro, C/C++, COBOL and HTML; analyze, design, develop and maintain data models on MS SOL Server and develop stored procedures using Transact SOL. Require: Master's degree in Computer Science or Management Information Systems and two years experience in the job offered or as Programmer/Analyst. Salary: $65,000 per year, 40 hours/week, 8 am to 5 pm, M-F. Mail resume to: Douglas B. Stastny, Director of Programming & Development, CAM Systems, Inc., 1776 Peachtree Street, NW, Suite 400N, Atlanta, GA 30309-2307 (Ref. No. HC001).

Systems Engineer - Atlanta, GA & various client sites in GA Design, dvlp, modify & upgrade the Product Administration & Release Control (PARC) system using source Code Control System (SCCS) and Revision Control System (RCS). Dvlp & maintain Build/install Process with nmake and kornshell. Dvlp & maintain client/server feed back system with Oracle database & Tuxedo using C++, Unix. Must have: MS in Comp Sci plus 3 yrs exp in job offered or as Electrical Egr. or S/W Egr (or BS+5yrs exp); Exp in UNIX, C++, SCCS, RCS, NMAKE and Tuxedo. 40hrs/wk M-F 9am-5pm $70K/yr Apply in person or mail resume to GA DOL, Job Order #GA 6497413, 465 Big Shanty Rd., Marietta, GA 30066 or the nearest DOL Field Service Office.

Computer Systems Engineer. Design & develop SAP/R3 software programs/applications for clientele in telecommunication, oil and banking industry using ABAP 4 programming language. Administer computer systems, networks and Oracle, SOL or Progress Database. Design satellite links and fiber optics for Latin American markets. BS/Computer Engineering; 2 years of experience as systems manager in banking, telecommunications or oil industry. Contact: Antonio Izquierdo, Miami Worldwide Trading Inc. at (305)557-1018.

Systems Administrator to provide production level UNIX Servers/Workstation PC, LAN & Market Data support & project leadership. Design, implement & support PCs and Market Data Systems critical to Trading Floor Applications. Provide high quality support in technical environment that includes NT, UNIX, networking & data communications. Work with vendors & telecommunications providers to provide high level service & stability. Provide direct end-user support to install & maintain SUN, PC hardware, operating systems & applications. Administer TIBCo Product & develop necessary programs to install, update & upgrade. Evaluate new applications & services; design & implement new infrastructure components & provide systems integration w/internal & 3rd party systems. Work w/vendors to test, install & troubleshoot applications. Work w/network & other support groups to implement & support company's technology. Requires B.Sc. in CS or Electrical/Electronics Engineering plus 2 yrs experience in job offered or 2 yrs exper as UNIX/NT Systems Administrator. Other special requirements: demonstrated expertise in design & development of local & wide area networks ("LAN" and "WAN"); demonstrated expertise performing administration & upgrades of market trading systems TIBCo, Reuters or OPEN Bloomberg; & demonstrated expertise performing network programming in shell scripts, Perl scripts, TCL or EXPECT. Sal.: $65,000/yr; M-F, 9A-5P. Send 2 resumes to: Case Number 19983990, PO Box 8968, Boston, MA 02114. EOE. Applicants must be U.S. workers eligible to accept full-time employment in U.S.

SOFTWARE ENGINEER: Design and development of DB2 applications, including the ability to write efficient queries using SQL in DB2 environment: Expertise in using OMF, SAS & EZTRIEVE reporting tools; Proficiency in Black Box & White Box applications testing methodologies; Demonstrated debugging ability using XPEDITOR and INTER TEST BATCH. Job duties are Analyze business system and data management process; identify problems and opportunities for improvement in converting data to programmable form; upgrade and revise system currently in place; determine output requirements and assure conformity with same; develop' test' implement and debug new software; correct problems as required. Requires Masters in Computers with 6 months of software development experience. 40 hours per week at $ 62,000 per year. Please send resume to Case # 19992105, PO Box # 8968, Boston, MA 02114.

Job # WEB92199-- Programmer Analyst--Plans, developsand documents computer programs, applying computer science, engineering and mathematical analysis using Developer 2000, Oracle 7.x and 8.x and Crystal Reports. Analyzes, reviews and alters programs to increase operating efficiency. Performs testing and user training after development. Work involves extensive travel and frequent relocation. Must have at least one year of experience with Oracle 8.0, Developer 2000 and Crystal Reports. Must have Master's degree in one of several limited fields: engineering, mathematics, physics, computer science or chemistry. 40 hrs/wk, 9am-5pm, M-F. $63,000/yr. Submit resume referencing above job # to: Tom Dembosky, Manager, Indiana Job Center, 350 N. Fourth Street, Indiana, PA 15701.

Computer- Multiple openings for Programmer Analysts/Software Engineers/Unix System & Network Engineers/Project Leaders. Candidates must have minimum BS/MS in Computer Science or related field and exp. in one or more of the following areas: Object Oriented Programming, WAN, C/C+ +, Corba, Oracle, Java- Internet Development, Sybase Application Development, Database Warehousing, side development, Back Office Server,Sun servers, NT engineering-exchange, SMS, Middleware development, Sun OS,Unix-Solaris System & Network Administration. PIs submit resume with salary requirements to: Open Systems Technologies, 155 Massachusetts Ave,. Ste # 301, Boston, MA 02115.

Job # WEB 92194--Database Design Analyst--Creates Databases and batabase object, downloads data from mainframe and populates Oracle and SYBASE databases, tuning queries for performance. Writes COBOL code to format data on mainframe so that it can be loaded to Oracle and SYBASE. Work involves extensive travel and frequent relocation. Must have at least 2 yrs experience using DB2, Oracle and IBM Mainframe. Master's degree required in one of several limited fields: engineering, computer science, mathematics, physics or chemistry. Submit resume referencing above job # to Tom Dembosky, Manager, Indiana Job Center, 350 N. Fourth Street, Indiana, PA 15701.

Programmer Analyst, Stoneham, MA; Analyze, design and develop applications in Oracle and Foxbase using SQL *Plus, PL/SOL, SQL*FORMS, SQL *Report and SQL*Loader. Perform Oracle Database administration tasks. Provide technical support. Req'd. Masters* in Phy/Math or Comp. Scie. or Engg. 1 *yr. exp in job offered or 1 yr. exp as Senior Executive-Automation Application Engineer. *Will accept Bachelors degree & 5 yrs. experience in lieu of Masters & 1 yr exp. 40hrs/wk., 9a-6p., Mon-Fri., $76,252/Per Year. Applicants should submit two (2) copies of resume in response to Case #19990911, P.O. Box 8968, Boston, MA 02114.

Computer People Source Services, Inc. a nationwide technology provider has multiple openings for computer professionals with skills including:

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Require MS/BS (with exp. in computer field). Excellent Benefits. Apply to: Attn: HR Dept, 47 Perimeter Center East Ste 320, Atlanta, GA 30346. E-Mail: hr@peoplesourceservices.com. FAX: 800-246-0437

Software Engineers to design, develop and maintain mission critical Client/Server and ERP applications; develop database appl with GUI, using OOAD on Windows and UNIX OS; analyze and develop business and web appl using PowerBuilder, Rational Rose, Erwin, SmartStream, Sybase, DB Artisan, Oracle, Java, Weblogic, ColdFusion, Java Script, NetDynamics, HTML, XML and VB. Require: MS in CS/Info Systems/Comp Appl or Engg (any branch) with 1yr exp. in the IT field. Salary: $70,000/yr full time. 50% travel. Resumes to Cosyne Enterprises, Inc, 3235 Satellite Blvd., Bldg. 400, Suite 300, Duluth, GA 30096.

SOFTWARE ENGINEER: Software conversion regarding year 2000 issues analyzing large code bases written in various lanuages, modifying proprietarty software tools to aid in the identification and remediation of Year 2000 (Y2K) problems, Y2K problems, and conducting texts to ensure that the systems meet their intended functionality. Requires: M.S. in C.S., Electronic Eng. or related field. Ability in software development including experience in remediating Year 2000 problems. Knowledge of C, Visual Basic, PowerBuilder, Oracle, Sybase, SOL Server, UNIX and Windows NT, 40 hrs/wk (9 to 5); $66,000/yr. Send two resumes/responsé to Case # 19990952, Box 8968, Boston, MA 02114.

Fulltime Engineering Manager responsible for managing a group of engineers developing Diagnostic Software. Must have Bachelor's in EE or foreign degree equivalent. Must have 3 yrs exp. Salary $75,000/yr.

Send resume to :

Nanda Chheda,

American Megratrends, Inc.

6145 F Northbelt Parkway.

Norcross, Ga. 30071

Purchasing Mgr for Electronic Products. Direct & coordinate the pruchase of computer products from US & internat'l vendors. Develop & establish business contacts & relationships w/manufacturers of electronic and computer products in US and overseas. Research & analyze worldwide markets for superior quality products at the lowest prices. Must travel frequently & possess excellent communication skills in Spanish to negotiate & deal with manufacturers & customers in South/Latin America. Bachelor in Electronics Engineering Technology; 2 years of experience as Technical Supervisor for Electronic Equipment. Contact: Ajay Khanna, Compubras Inc. 100 SE 1st Street, Suite 50, Miami, Fl. 33131 (305)0379-0900.

SOFTWARE SPECIALIST: Responsible for routine to complex software design, development, integrated testing and maintenance of real-time industrial automation software. Develop project plans in conjunction with team. Debug and test code. Write project documentation which will include plans and specifications. Write code using various computer languages. Requires: M.S. in C.S., E.E. or related field and 2 years experience in real-time control applications. Demonstrated skills in VC++, MFC, VBA technologies and Windows NT platform knowledge. 40 hrs/wk (9 to 5); $72,500/yr. Send two resumes/response to Case #19991028, Box 8968, Boston, MA 02114.

PC Support Specialist wanted by Co involved in Comp Training & Educational Materials in Edison, NJ to install, modify & make minor repairs to microcomputer h/ware & s/ware systems & provide technical assistance & training to system users. Must have Bach in Comp Sci, Comp Engg or Elec Engg. Respond to: HR Dept, PC Age II, LLC, 2 Ethel Rd, Ste 204A, Edison, NJ 08817.

Programmer-Analysts: Install/integrate/support/maintain IMPACT software systems; perform COBOL/Flexgen programming; set & test software & troubleshoot. Support existing systems created with FlexGen. Req. Bachelors (or equiv. in experience or any combin. of education & experience) in Computer Science/related field plus 3 yrs exp in job offered, or as FlexGen/Impact User Support Analyst. Fax resume to: HR 770-951-9627.

PROJECT MANAGER (NASHUA) Seli, negotiate, present and implement proAlpha-software products using ERP software knowledge/computer skills, project mgmt and consulting tools and exp. Create project budgets, prepare and conduct-customer workshops, software config. and end user training. German language skills req. Req'd: BA deg. or U.S. equiv. in Engineering, 2 yrs. exp. in job offered or 2 yrs. exp. as Research Asst. 40 Hrs./Week, 9AM-5PM, R/P: $65,000.00/yr. Submit resume describing your qualifications, in duplicate, to: Job Order # 2000-199, P.O. Box 989, Concord, NH 03302-0989.

Web Developer, N. Bethesda, MD. Design, Develop, administer & support company's Web site, using C/C++, Perl, Java, HTML, DHTML, SOL, & Shell programming languages; & design graphic arts elements for Graphic User Interface using Adobe Photoshop, Adobe Illustrator, Macromedia Flash, Corel Draw & Corel Xara software tools for Windows NT/98 & Unix operating systems. Reqd. B.S. C. S. or equiv. & 2 yrs exp. M-F, 40hrs/wk + O/T. Send Resume to K Durazo, HR, Ref. #401, InforMax, Inc., 6010 Executive Blvd., 10th Floor, N. Bethesda, MD 20852.

SOFTWARE ENGINEER: Develop software at client sites in C, C++, under Windows 95, Windows NT, OS/2 using tools such as MFC, OLE, ODBC, C-SDK, SOL, COM and DCOM. Req'd. Bachelor's degree or equivalent in Comp. Sci/Engg. or related and 2 years of experience in the job offered or in a related occupation-Software Engineering/Consulting. 40 hours, 8:00a.m.-5:00p.m., $76,252.80/yearly. Must be willing to travel and relocate. Several positions available. Send 2 copies of resume to Case # 19984075, P.O. Box #8968, Boston, MA 02114.

Programmer/Analyst sought by Computer Services Firm in Edison, NJ. Must have Bach in Comp Sci, Comp Engg or Elec Engg & 1 yr exp planning, dvplg, testing & documenting client/server applics using Developer/200, SOL, PL/SOL, shell & C with Oracle dbase in Win & UNIX. Respond to: HR Dept, Horizon Companies, Inc., 5 Lincoln Highway, Edison, NJ 08820.

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We are a fast growing Consulting company based in New Jersey.
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Send your resume to
Rod McFadden
Kama Consulting
Fax:201-934-7166
Email:Kamaco@aol.com

Instructor, Computer Science, wanted to teach Comp. Sci. courses, incl. but not limited to C/C++, Object Oriented Design, Data Structures, Assembly, Visual Basic, Pascal & Java; teach Comp. Applications; curriculum & course develop.; part. in college committees; advise students; pilot new technologies; & part. in grant proposals. Must have Master's Deg. in Comp. Sci., 1 yr. college level teaching exper. incl. exper. at community college level & 1 yr. programming exper. (exper. can be concurrent). Salary $33,145/yr., 40/hrs/wk. Send two (2) resumes to Case #19991055, P.O.Box 8968, Boston, MA 02114.

Aleph Computer Systems Inc. is seeking a Software Engineer, must have Bachelors in Comp. Sci. or Engg and 2 yrs. exp. in dsgng, & dvlg business applic. s/ware in client/server setup and Win & UNIX using C++, VB, Business Objects Reporting, SQL.

Send resume to H.R. Dept. Aleph Computer Systems, Inc. 11-49 47th Ave. LIC, NY 11101.

Several positions available, including Software Engineers, and Sr.Software Engineers in a variety of areas.

Requirements and salary vary per position.

Send resume to:

Nanda Chheda,
American Megatrends, Inc.
6145F Northbelt Parkway,
Norcross, Georgia 30071

SENIOR SOFTWARE ENGINEER

with 2 years of computer-related experience to design, develop and implement software applications using Oracle, Developer 2000, SQL, and Unix. Excellent communications skills and a Master's degree or equivalent required. FAX resume to HR 7819374976 or email: tbetti@raymondkarsan.com

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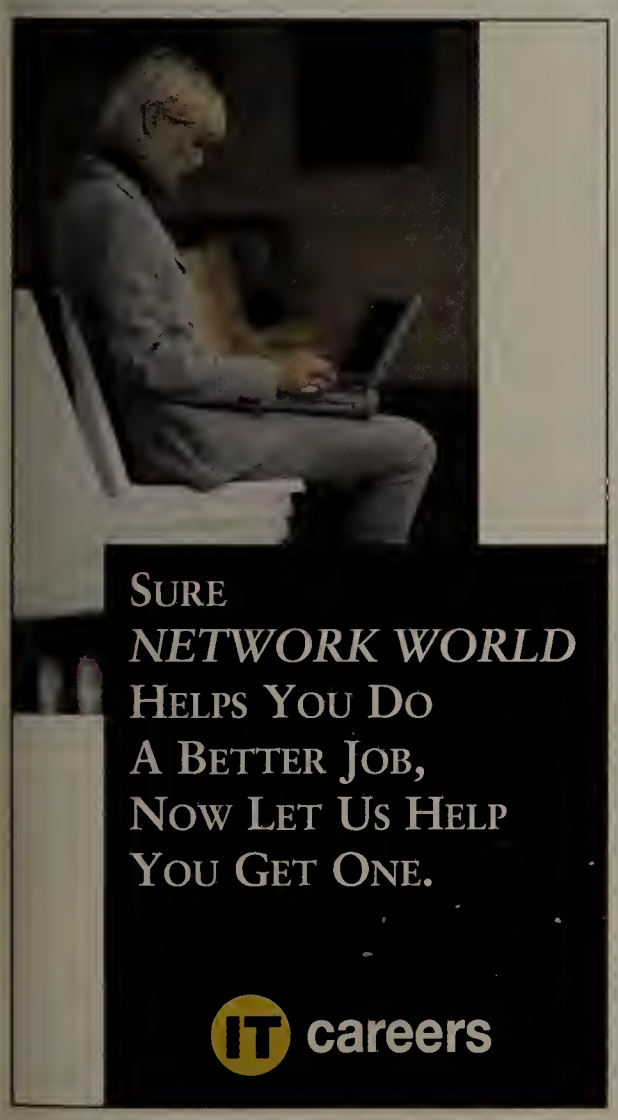

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IT careers COMPUTERWORLD

IT Careers in Illinois

by Carole Hedden

The West Coast and the East Coast are not the only lands of IT innovation. In Illinois there are mega hitters in the IT game — companies with a long history and those who have created entirely new business models, companies large and small, known for their consulting prowess and production of new software and integration tools.

In fact, the third largest market for IT jobs in the United States is in Chicago along Interstate 88, what's known as the R&D Corridor in the Windy City. Unlike other IT power communities, the watchwords here include not only innovation and creativity, but also words like loyalty and enduring business.

In Illinois there are mega hitters in the IT game

Sentinel Technologies, Inc.

Downers Grove, IL

Nestled down between the Lucent Technologies and Arthur Andersen's found in Chicago, Sentinel Technologies is a technology firm that's been around for nearly 20 years. From its beginnings as an IBM mainframe support firm, Sentinel has reinvented itself several times to adjust to shifting needs and technologies – to client/server and now to utilization of emerging technologies.

"Our new credo is we provide intelligent ideas and integrated solutions," says Brian Osborne, executive vice president of sales and marketing. With capabilities in designing emerging technology solutions and complete support for existing platforms, the company is positioned to do just that. Sentinel's two new practice areas, which address emerging technologies, are computer telephony integration (CTI) and e-business, two markets projected to experience tremendous growth. "As these technologies become more mainstream, they'll move into another portion of our business, which today includes design and deployment of technologies such as Microsoft and Cisco. Behind these two areas, we have a strong support business to assist our customers with hardware and software failures or application issues. We handle those 24-by-7."

Osborne says that one of the strengths of Sentinel, for employees and customers, is that there are a variety of skills and projects. "You can move between e-commerce, computer telephony integration, network security or field service," Osborne explains. "These areas offer varying levels of complexity so that you can grow. What has changed is what is viewed as entry level – a few years ago it was your ability to work with basic programs and some installation experience. Today, entry level is someone with enterprise level experience, a business consulting background, and people who can provide business solutions, not just technology."

Successful candidates tend to be those people who have at minimum mainstream technology experience, but just as importantly those who have demonstrated an ability to learn and to design and deploy technologies that are the correct answers for customers' businesses. Osborne says the company not only looks for people who can design but also present technological solutions.

"There are a lot of reasons to choose Sentinel as your place to work," says Osborne. "Our management team has been together, on average, 14 years. We've successfully navigated through the changes in this industry over the past two decades. We have a career plan that helps you stay on track and provides you with the ability to grow – and we reward that growth and pay you for what you bring to the business. In addition, our model of providing complete support services for emerging and existing platforms helps to insulate us from the peaks and valleys that so many technology-based companies experience. Also, emerging technology services gives us a way to develop core competencies early on, while feeding our other areas as they gain market acceptance. It's designed to be a sort of self-perpetuating, continuous cycle.

"One of the most important aspects of this company is that we are people who get gratification from doing excellent work and helping customers – that's no quick fix, rags to riches model. It's an enduring business model."

United Stationers

Des Plaines, IL

In the world of office supplies and equipment, United Stationers is among the leaders with $3.4 billion in sales in 1999. "Broadly, we provide office products, office furniture, computer supplies, office machines, and janitorial and sanitation products," explains Ergin Uskup, vice president of management information systems and CIO. "We distribute through a network of 66 warehouses, delivering most anything to our commercial customers within a 10-hour window."

This capability – to serve the office supply resellers that fall outside the realm of the major chains – is based on the evolving tool known as e-commerce. "In the sense of e-commerce, about 93 percent of our business has involved a transaction directly from a customer computer to ours," says Uskup. Over the past three years, this has begun to change with United Stationers developing an interactive Internet presence with the resellers who are the company's customers.

The company began about two and a half years ago to write shrink wrap software to enable their customers to do e-commerce. "Because a lot of our customers are small to medium-sized businesses, without IT staffs, we developed software to enable customers to be on the web, to use this capability," Uskup adds. "We host the system, which can be tailored by our customers, including how they charge taxes, their freight costs and the look and feel. Recently, we have partnered with another company, Internet Office Solutions & Services, who is in the process of offering enhanced versions of this software, as well as hosting services and support."

United Stationers has a multi-platform environment to support its distribution business. "We need people who can support and enhance the existing mainframe, client/server, Internet systems and build new ones on these platforms. It's important to be able to work in teams and to have some experience in distribution or supply chain management as well as the e-commerce environment. We're looking for project managers, business analysts, programmers and technical analysts (database, distributing computing, telecommunications and operating systems," Uskup says. "The most important skill, though, is the ability to learn and work in teams. We put a lot of emphasis on training and teamwork so these are key."

Uskup says the goal is for United Stationers to be the best place to work in the Chicago area. Already the company has won several laurels – ranking 53rd in *Information Week's* list of "500 Most Innovative IT Organizations" in 1999 and among the best in *Computerworld's "100 Best Places to Work in IT."* "We work very hard to make this place intellectually challenging, where you feel good about your work and have fun," says Uskup. "We pay attention to the details."

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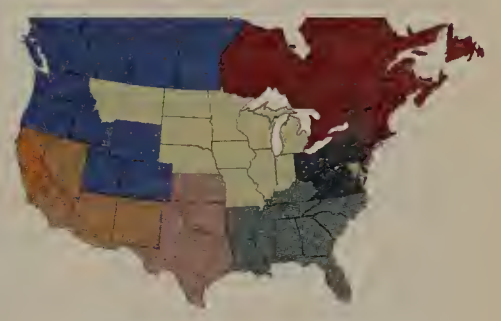

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Qwest,
continued from page 14

be built in the US West region with IBM — and instead instruct its routers to hand traffic off to Touch America until Qwest exits the region.

And in language strikingly at odds with initial statements by Qwest officials extolling Touch America's capabilities, the divestiture plan reveals a range of support services that Touch America will have to subcontract from Qwest for the first six to 12 months.

For example, Qwest will provide order-entry service to Touch America, including "manually entering handwritten data from sales forms into computer systems to set up new accounts." Qwest also will segregate a group of customer-service agents for large business customers in its own call center to answer the phones for Touch America.

Worries behind the scenes?

In filings with the FCC, Qwest says US West will have a strong incentive to obtain long-distance authority because until then Qwest will have marketing and operational problems . . .

. . . with regard to long-distance voice and data services:

> "In marketing its services out-of-region [outside US West], Qwest will be at a significant disadvantage to other carriers that can offer service on a nationwide basis."

. . . with regard to Internet services:

> "The [divestiture plan] creates major operational inefficiencies for Qwest by comparison with any other Tier 1 ISP."

Those provisions gave several analysts pause about the transition. "It says to me that they're certainly not ready to do it," says Dick Kuehn, president of RAK Associates, a Cleveland firm that assists users negotiating carrier contracts. "[Touch America] should have their own customer-care call center at this point. It's no great trick to expand the number of stations."

Qwest officials last week stood by their written statements. Until US West gains long-distance authority, "it's a situation in which we have in essence two-stop shopping," says Steve Davis, senior vice president of government affairs. He says Qwest told the FCC about the negative impact of the divestiture to show how the merger gives US West increased motivation to gain long-distance authority so Qwest can carry traffic nationally again.

Yet the divestiture plan reveals that even if US West does start gaining long-distance approvals, current Qwest customers will be unable to go back to Qwest for three years because of a noncompete agreement with Touch America.

"That's really ugly," Kuehn says. "Let's say I wanted to stay with Qwest all along, they get back into long-distance and I still have no choice at that point. That's nuts."

Some industry observers charge that the FCC's questions asking whether Qwest will get rid of Web servers and access in the US West territory are unfair because Bells without a long-distance owner offer some of these services. "That could be a deal-killer right there," says Alan Pearce, president of Information Age Economics, a Washington, D.C. consulting firm. If Qwest has to give up any Web hosting, "I would counsel them to take a walk on the deal because it's simply not worth it."

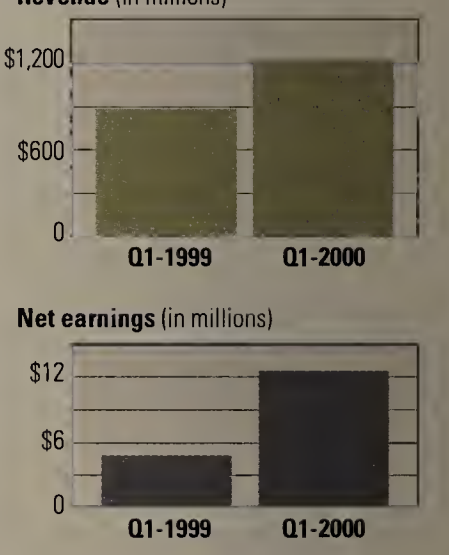
But Qwest users are bracing for a rocky ride. "I've got to change all my billing and see how much of a nightmare that is," says Dennis Romero, until recently a network manager and now a consultant for CQG in Denver, a financial information provider to trading firms with locations in and out of the US West region.

Lisa Pierce, an analyst with Giga Information Group, cautions that customers forced to split traffic between Qwest and another carrier may cross a network-to-network interconnection, and "service-level agreements [SLA] never extend beyond an NNI." A Qwest spokesman says the company is implementing a joint SLA with Touch America for existing services and is negotiating them with other carriers. But Pierce says complaints to regulators that the network split is cumbersome are "crocodile tears" because Qwest always knew it would have to make a divestiture to satisfy them.

"They're the ones who wanted this all along," she says. "So what's the problem?" ◪

The stakes grow higher

Qwest's revenue and earnings continue to grow as it grabs the leading position behind the Big 3 carriers:



Novell,
continued from page 9

did have the skill to diagnose abends properly, it would take several hours, most of which may occur when the server is down. Alternately, IT can call Novell's technical support to seek an answer that might take days or even weeks.

"The last time I had an abend, I called technical support and ended up e-mailing a file to them," says DiComo. "It would have been really easy to upload a file and get an automatic response."

Amy Lewis, a systems administrator at the University of Michigan in Ann Arbor, has already used the system to solve her abend problem. When she uploaded her abend log, she received a report recommending that she use a certain patch to fix the server. "I haven't had any abends in about a week," she says.

Novell declined to say if there would be a charge for the ABEND Analysis System, which will be available as part of a support package by the end of October. Not surprisingly, some users say Novell should provide the system for free.

"Novell's ABEND software should definitely be free," Carroll says. "It's in Novell's interests to have its software seen as being as stable as possible, particularly with the current competition. This is one area where Novell kills Microsoft and [the company] should keep it that way."

NetWare ABEND Analysis System: http://abend.provo.novell.com

Tips for solving NetWare server abends

Michael Carroll, an IT consultant to the Australian government, recommends these steps for fixing server abends if you don't have Alexander Server Protection Kit or Novell's ABEND Analysis System.

- Ask what changed on the server before the abend. Did set parameters, software upgrades or patch kits change?
- If something changed, roll back the changes. If nothing changed, look for obvious errors in cache buffers, packet errors or DSREPAIR.
- If it is a recurring abend, disable any nonessential modules and bring the server up without any unnecessary AUTOEXEC.NCF loads. See what happens.
- Start swapping hardware, and try loading the server again.
- At any point in the troubleshooting, your actions may change depending on test results and information you have gathered.

UCCnet,
continued from page 12

benefit smaller companies that shy away from EDI, Zwanziger says. Importantly, XML schemas — which describe XML data content — support Internet-based real-time interactions far better than batch-oriented EDI. Many vendors, including Supervalu's EDI software provider Harbinger, have developed products that translate EDI into XML to support coexistence between the old and the new.

No other online supply chain has yet embraced UCCnet's exact model, but some analysts say UCC's contribution to online business-to-business commerce will be important.

"There's a fair amount of confusion in the market right now," says Janet Suleski, industry analyst for retail advisory services at the Boston consultancy AMR Research. She pointed out that the need for standards is going to become clearer as the number of exchanges proliferates. UCC's track record makes it a good candidate to lead the charge, she says.

Nonetheless, not all corporations are welcoming business-to-business supply-chain-style exchanges.

According to Chief Information Officer Kevin Turner, Wal-Mart is in favor of operating an exchange for itself, but is reluctant to join one that includes competitors.

"We would have to ask our competition every time we wanted to make a change," Turner said during his keynote address at Retail Systems 2000. "It's not something we care to do." In addition, Wal-Mart worries that competitors might somehow seize important business information if it were stored or transacted through a shared business-to-business exchange.

Today, Wal-Mart manages a large number of its buyer and supply relationships through an EDI-based extranet called RetailLink. ◪

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Microsoft backs down on Windows Me deletions

BY JOHN FONTANA

REDMOND, WASH. — Microsoft has relented to customer demands and will include key LAN functionality in the forthcoming release of Windows Millennium Edition (Me).

But Microsoft is unsure if it will supply an Active Directory client with Windows Me — a consumer product, which analysts say could find its way into corporations. Customers and analysts alike say it is critical to have a directory client so users can reap the security and user management benefits of Active Directory, an important piece of Windows 2000 server.

In March, Microsoft raised the ire of customers when it confirmed it had stripped from Windows Me the software required to connect the operating system to NetWare or Banyan (now called ePresence) file servers, but left the client needed to connect to Windows NT servers. Microsoft also said Me would not have Active Directory support.

Without the directory client, users will not be able to connect to Win 2000's directory. Microsoft has already announced an Active Directory client for Windows 95 and 98.

"If Microsoft wants Active Directory to be at the center of its all-Internetwide platform, Me better have a client for the directory," says Juan Mota, manager of system integration for Excell Agent Services, a call center in Phoenix. Mota and other enterprise users who are committed to Windows 95 and 98 for telecommuters were shocked to find they would lose the ability to integrate Windows Me, the successor to 98, with their heterogeneous networks

"With Active Directory, we can manage our customers and users much better, and if Me can't talk to the directory, we go back to the old user name and password, and all those security concerns," he says.

Analysts agree that Microsoft must address this issue.

"There will be an Active Directory client for Windows 9.X, and indeed it may run on Me. However, what we are looking for from Microsoft is an explicit commitment that they will support this configuration," says Neil MacDonald, an analyst with the Gartner Group, which first brought the Me issue to light.

Microsoft continues to hedge, but, "We're continuing to look at providing an Active Directory client for Windows Me, but a final decision has yet to be made," says Shawn Sanford, group product manager for the Windows division.

In response to customer pleas, Microsoft returned LAN features to the third beta release of Me that was issued just two weeks ago, Sanford says. The final version is expected to ship in June.

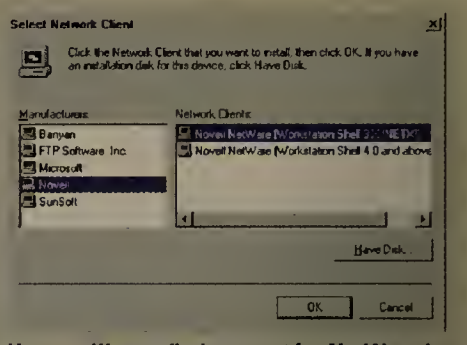
Microsoft will include a NetWare client, and Novell is developing one as well. But Microsoft will not include software that supports the installation of an ePresence client.

Gartner's MacDonald says with a network and Active Directory client, there is no technical reason why Me can't be used on corporate nets. But he warned enterprise users that Me only delays by a couple of years the inevitable need to upgrade applications and hardware to support Win 2000. ◪

Reinstalled Windows Me clients

Microsoft will offer a mixed bag of client support in Windows Me, its next consumer operations system.

LAN Features	Support in Beta 2	Support in Beta 3
NetWare client	No	Yes
Banyan (ePresence) client	No	No
Active Directory client	No	Still undetermined



Users will now find support for NetWare in Windows Me.

Kerberos, continued from page 9

cation and authorization regardless of the network operating system.

But Microsoft's implementation of Kerberos uses proprietary data, called a Privilege Access Certificate (PAC), in its Kerberos "tickets." The result is that tickets generated by third-party Kerberos servers, or Key Distribution Centers (KDC), are not valid to access Windows resources, such as files, applications or network devices, even though the KDCs are built around the same Kerberos Version 5 standard.

Microsoft has been saying for more than two years that it would publish PAC data as a way to foster interoperability.

Microsoft followed the Kerberos Version 5 specification but used the PAC in the specification's "auth-data field" on the Kerberos ticket to insert Windows Secure ID information that bounds tickets to Windows Access Control Lists.

The Open Group, which develops DCE Kerberos, and the Massachusetts Institute of Technology, which develops a free KDC, also use the auth-data field to provide user ID but freely publish the data format.

Customers want Microsoft to address the restriction.

"Yes, I would like to see this information published, but whether it would help us with interoperability, I really don't know yet," says Al Williams, director of distributed systems services at Pennsylvania State University's Center for Academic Computing. He has more than 200,000 Kerberos user IDs on a Unix-based KDC and is rolling out Win 2000. Williams says he does not want licensing restrictions and he would not consider Microsoft's Kerberos "standards-based" if licenses are required.

"An open model tends to encourage cooperative partnerships. We feel that type of arrangement is better for all involved," Williams says.

Microsoft officials would not comment on their plans for publishing the PAC data.

Regardless, some say requiring PAC licenses is a way to keep Kerberos users tied to Microsoft.

"We are happy they are living up to their promise of disclosure [of the PAC]," says Paul Hill, a senior programmer analyst at MIT and a member of Kerberos Version 5 development team. "But we are not really happy that they want everyone to license the technology."

MIT's version of Kerberos is freely available, and Hill says MIT won't license the PAC for its server. "How would we pay for it? Our server is free. Putting PAC support in our server just won't happen," he says.

Microsoft, according to sources, hopes developers use the PAC in their applications, therefore tying them into the Win 2000 KDC. That would force non-Windows KDCs to have a trust relationship with Win 2000 KDCs in order to access those applications.

Microsoft could also allow KDC vendors to license and "clone" the PAC on their KDC without running a Win 2000 KDC, but it is not clear if that will be permitted. That would let users bypass Win 2000 and rely on a Unix KDC. But users running Kerberos and Windows applications — such as SQL, Exchange or Internet Information Server — would still have to pay Microsoft for either Win 2000 or for the PAC data format to support access to those resources from a non-Microsoft KDC.

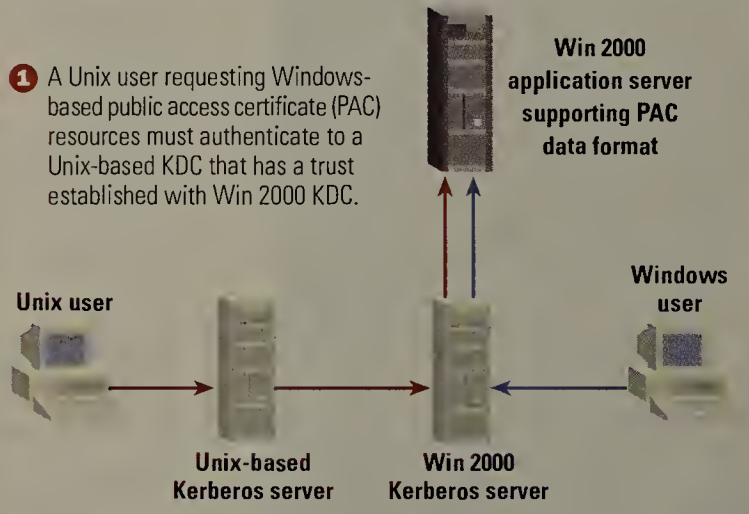
"Microsoft is using its dominance in the application market to help create a monopoly in the server market," Hill says. He's happy Microsoft is using Kerberos because it improves security across the Internet, but "for anyone who runs a competing KDC, Microsoft has usurped the standard and is destroying interoperability."

Analysts say Microsoft is carrying out its unique view of integration.

"This Kerberos tactic is more subtle than usual, but this is the way they promote one technology with another," says Michael Gartenberg, an analyst with the Gartner Group. ◪

Kerberos interoperability

While Microsoft is preparing to publish the proprietary data format used in its implementation of Kerberos Version 5, Unix-based Kerberos servers probably will have to continue relying on Windows 2000 Kerberos servers to access certain resources.



1. A Unix user requesting Windows-based public access certificate (PAC) resources must authenticate to a Unix-based KDC that has a trust established with Win 2000 KDC.
2. Windows users authenticate to Windows-based servers and get access to applications that support PAC data security.

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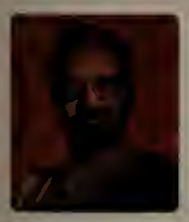

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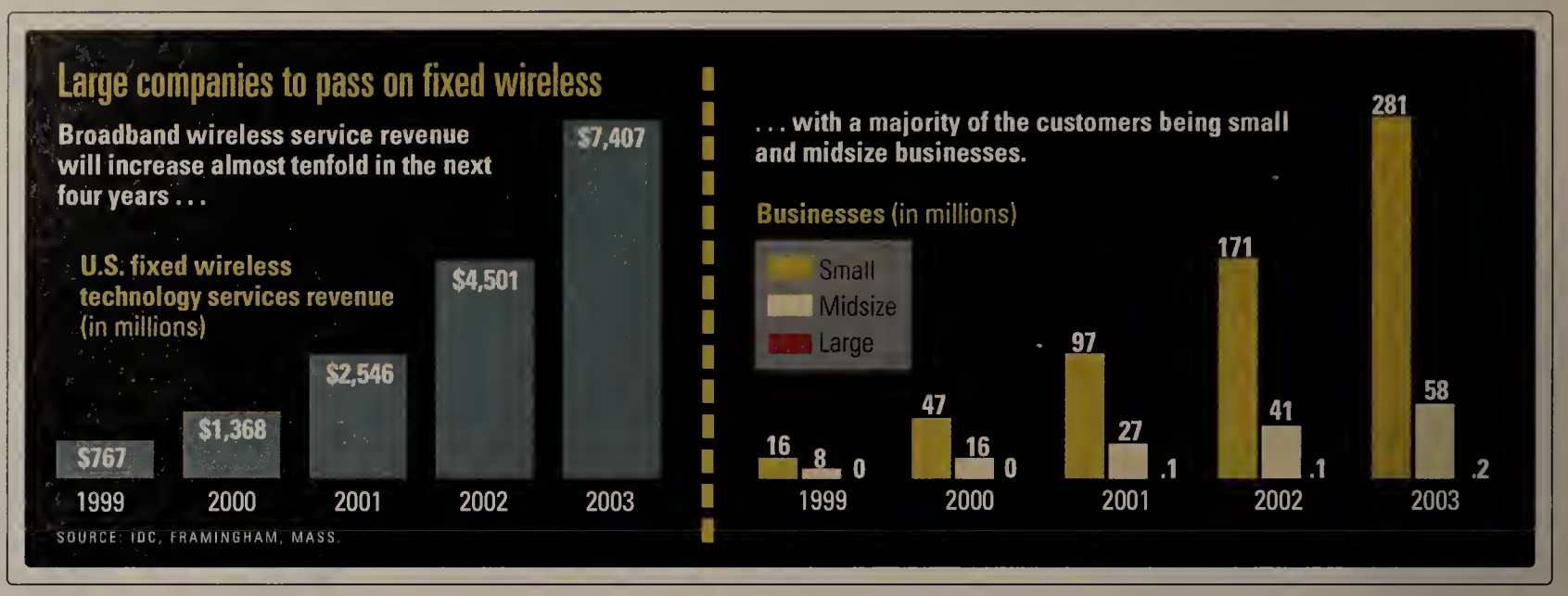
Last mile,
continued from page 9



Group. The same study says 300,000 DSL lines are in service, but other industry estimates are closer to 600,000. IDC, a market research firm in Framingham, Mass., expects DSL to surpass cable modems in 2003, while Cahners-Instat Group says that will happen in 2002.

Wireless is in distant third with more than 40,000 links in 1999 based on service provider reports. That figure outstrips the IDC estimate of just 30,000 links for last year.

While providers have made a modest start, competition seems about to heat up, as services become more widely available. DSL customers will soar to 13.9 million by the end of 2002, Cahners-Instat says. Leaders are the regional Bell operating companies — owners of the phone lines — with more than half the current customers, The Strategis Group says.

Cable modem users will jump from about 1.5 million in 1999 to 8.3 million in 2003, Cahners-Instat says. Excite@Home and RoadRunner are the runaway market leaders with 97% of existing customers between them.

Fixed wireless hasn't gotten as far yet, but it is growing rapidly. Users are expected to spend $828 million this year on fixed wireless, nearly triple what they spent on the technology last year, IDC says. The big names are Teligent and WinStar, with Nextlink, Sprint and MCI WorldCom waiting in the wings with fistfuls of wireless licenses.

While this level of growth sounds impressive, some experts say wireless cannot keep up in the long run. "That is absolutely, positively not going to happen," says Tom Nolle, president of CIMI, a technology assessment firm in Voorhees, N.J.

Still, wireless will have its place, bypassing local terrestrial access to long-distance networks at T-1 speeds or slower for less than the price of a T-1, says Jim Lawrence, program director at Stratecast Partners in Mountain View, Calif.

BROADBAND ACCESS BLITZ
First in a three-part series.

Big investment

In an attempt to broaden availability of their offerings, service providers are digging deep into their pockets to fund their networks.

The top seven cable carriers invested between $9 billion and $11 billion last year to upgrade their networks, according to The Strategis Group. That is on top of about $6 billion they spent in 1998. Some of that investment will bring cable networks' fiber backbones directly to business customers. Direct fiber represents yet another broadband access technology, but it is much less widely deployed.

"Cable doesn't go to most businesses today, but I expect AT&T to change all that," says Robert Larribeau, an analyst with consultancy RHK.

In the DSL arena, jumbo Bell company SBC Communications is pouring in $6 billion to upgrade its network so DSL can reach 80% of its customers by 2002.

Major competitive local exchange carriers focused on DSL, such as Covad Communications, NorthPoint and Rhythms NetConnections, are also investing huge sums. It costs competitive carriers up to $250,000 or more just to get space for their DSL gear in RBOC switching offices.

Wireless carriers, for their part, have spent billions of dollars to acquire Federal Communications Commission licenses to use the airwaves.

These efforts have borne fruit for some customers who happen to live in areas where cable modem and DSL services overlap. Advertising wars have broken out over this.

For example, Pacific Bell sells DSL in areas of California where a variety of companies offer cable modem services. PacBell runs TV advertisements depicting suburban anarchy that stems from too many people vying for limited bandwidth on cable networks. The ads portray neighbors, desperate to keep their access fast, cutting cable lines to other homes, spray painting "Cable hog" on houses and shunning newcomers as they move in because they represent another drain on limited bandwidth.

Such images make for good TV, but they don't reflect what is really happening, says Ray Keneipp, an analyst with the Burton Group. "I don't think technologies compete with each other. Companies that employ these technologies compete with each other."

From the evidence, he is right. Service providers are mixing and matching their offers to reach as many customers as possible. They don't seem to care which of their services the customers buy, as long as they are buying broadband access.

AT&T, for example, has staked its local access future on cable modems, spending more than $100 billion to buy and upgrade cable networks. But the carrier also spent $11 billion on TCG, a local fiber network in cities nationwide.

In addition, AT&T says it will fill in with DSL and wireless in areas its cable networks miss.

Similarly, Excite@Home, the largest provider of cable modem service, says it will supplement its access network with DSL it wholesales from Rhythms.

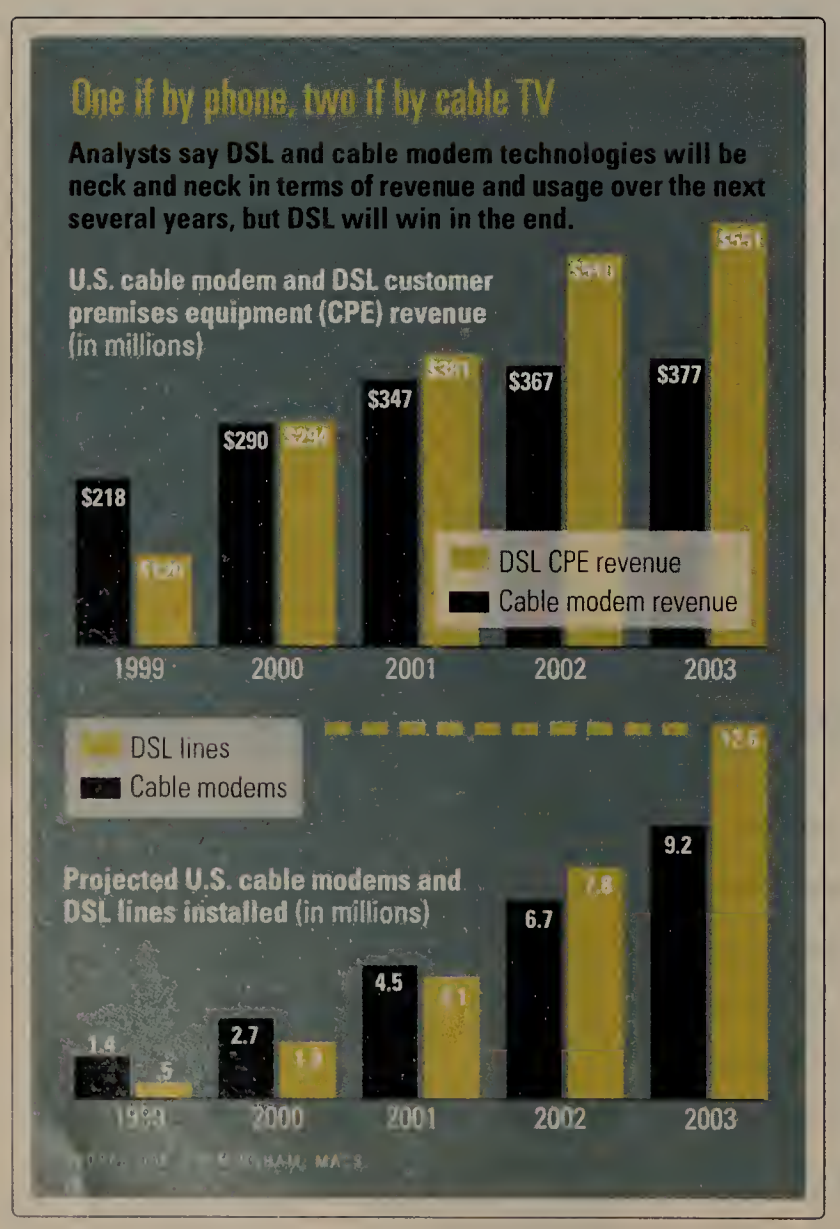
Nextlink, a service provider that owns most of the licenses for wireless local multipoint distribution services, says it will sell DSL services to connect customers to its network.

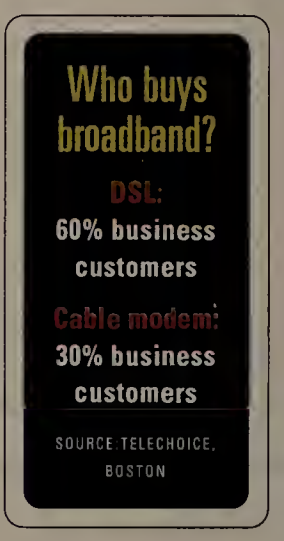
Ultimately, it won't matter to customers what the access method is so long as it's fast, says Nick Stanley, an analyst with Communications Industry Research in Charlottesville, Va. "The fact that it's coming in on a dish from the rooftop or from a cable, they are not going to care," Stanley says.

But other analysts distinguish between the technologies. DSL is better suited to business uses than cable or wireless, says Brad Baldwin, an analyst with IDC.

"The Achilles' heel of cable is it's a shared network," he says. To mask that, some carriers are downgrading speeds to just

See **Last mile**, page 152





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IBM to unveil high-speed network chip

Company claims its Power Network Processor can boost network thoughput up to 30%.

BY MARC SONGINI

IBM will soon debut a high-speed network chip that promises to help users implement quality-of-service rules in their companies.

The company claims the IBM Power Network Processor, formerly code-named Rainier, can boost network throughput in devices by about 30%, as well as support high-speed encryption and decryption services. While IBM is out of the IP-Ethernet hardware business, it is still a significant OEM contributor to other vendors' devices, industry observers note. Big Blue competes with companies such as Lucent and Motorola to win the business of network vendors.

Members of IBM's microelectronics division are expected to show off the Power Network Processor at the upcoming NetWorld+ Interop 2000 in Las Vegas. The programmable chip will work in high-end IP devices and support Layer 2, 3, 4 and 5 switching and routing. IBM sources say the Power Network Processor will be used in a prototype IP switch at Interop.

NETWORLD+INTEROP 2000 PREVIEW

The chip will run traffic at wire speed, IBM says. Initially, it will support 40 Fast Ethernet and four Gigabit Ethernet ports. It also supports packet-over-SONET traffic. Network managers will be able to program the chip to recognize priority IP packets and assign them bandwidth in advance. This will assist in implementing QoS or Differentiated Services throughout the network, IBM says.

While the company won't divulge names, it says there are a number of large network vendors interested in using the chip in their devices. These companies may include some of IBM's current chip customers, such as Alcatel or Nortel Networks.

IBM is one of the market leaders in the network chip field, says Frank Dzubeck, head of Communications Network Architects, a Washington, D.C. consultancy.

The chips allow the network device manufacturers to reduce the number of individual components in their switches and routers, making the gear cheaper for end users. In the future, such chips from IBM could make OC-192 devices possible, he says. ◪

Maxspeed, continued from page 16

But, he says, thin clients definitely are not the best answer for all users in a company. For users who need to tailor their systems' software, or run processor-intensive applications, the traditional desktop will still be the best choice.

For transaction-type applications, thin clients will be an important tool because they give users access to what they need and require very little maintenance. Also, software upgrades can be done on a single machine as opposed to hundreds, or even thousands, of clients. As point-of-sale machines and terminal replacements, these desktops could be a logical choice.

And even though Linux is still in its infancy in terms of use on corporate desktops, its use as a server operating system is expected to grow leaps and bounds over the next few years. Kusnetzky says Linux will become the second most popular server operating system by 2004 after Windows.

Familiar with Linux

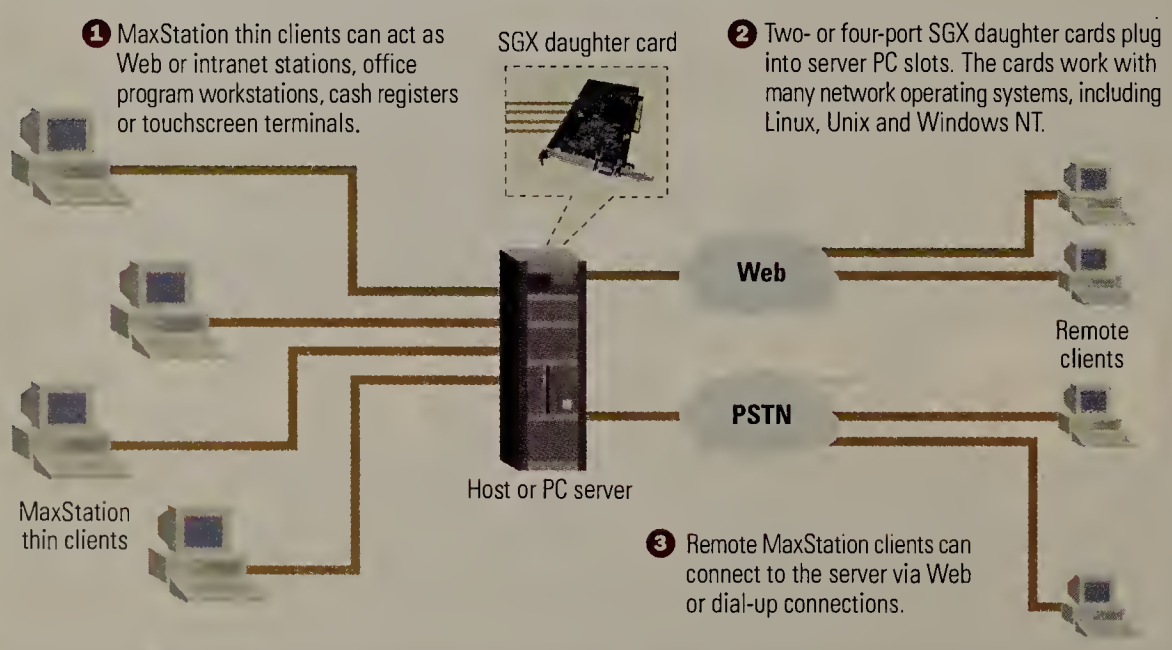
The Maxspeed-Corel offering will be available later this spring, but it won't be the first foray into the Linux market for either company. Maxspeed announced in February it would support Red Hat Linux on its +One Station, which sells for about $149. The device allows an end user to connect to a PC and share its resources, essentially having two desktops use one PC. The +One Station connects to any Linux-based PC, using standard Category 5 cable. It also supports 3-D graphics. For its part, Corel was one of the first companies to tailor a major productivity application for the Linux market.

In addition to its +One Station, Maxspeed also has the Maxspeed Station, a thin-client device for use with a host PC, server or workstation, and the MaxTerm Universal Terminal, a desktop that has a 233-, or 366-MHz on-board processor for running applications locally.

Maxspeed: www.maxspeed.com; Corel: www.corel.com

Network in a box

MaxStation thin clients and SGX daughter cards can be used to set up a simple network of terminals or network computers, and require no additional server software.



Last mile, continued from page 150

300K bit/sec, regardless of whether additional bandwidth is available. That way when more customers sign up and contend for bandwidth, existing customers won't see their service degrade, he says.

BROADBAND ACCESS BLITZ
First in a three-part series.

DSL, on the other hand, gives customers their own link back to the carrier's network. If the customers are willing to pay for it, they can get guaranteed bandwidth from end to end, Baldwin says.

Wireless, while pricey compared to cable and DSL (it costs $150 for a modest 384K bit/sec connection) can fill the gap when other technologies aren't available, RHK's Larribeau says.

For now, customers seeking fast access to the Internet will take what they can get and afford. But that is all about to change, CIMI's Nolle says.

Cable modems, DSL and wireless can all offer T-1 speeds at less than the cost of T-1 lines, breaking the access choke point of 56K bit/sec set by the fastest dial-up modems.

That leaves open a world of possibilities such as voice and data traveling over the same access line, access to entertainment on that same circuit and the ability to easily switch from one ISP to another.

Next week: Technology advances on the horizon for broadband access.

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Backspin

Eh? E-? I-? Oh, you!

"E-government promises of . . . cost savings, improved service delivery and positive transformations of the governmental workplaces are real. However, a high rate of e-government project failures in the next several years may be unavoidable."

— French Caldwell, research director, Gartner Group

MARK GIBBS

The potential scale of these disasters scares the bejeesus out of me, but what bothers me most about this quote is not the frightening probability of governmental failure, but the use of "e-".

E-government! Gad, but am I tired of "e-this" and "i-that"! Everywhere you turn, virtually and otherwise, it is e-something. I just did a search for domain names beginning with "e-" and "i-", and I found more than 2,000 of each!

My good e-friend Mr. Sterne e-forwarded an e-message he received from Kent Davis that detailed the i-degree of e-insanity:

"I spent five years in Thailand and . . . learned to speak, read and write fluent Thai. Just last year, I noticed people starting to buy Thai-related domains like crazy. One trend was to buy 'e' and 'i' names [eThailand, iThailand, eThai, iThai, etc.].

"Many of these were bought by foreigners who [evidently] don't speak Thai [and many were bought by Thais caught up in the fever]. What's interesting is that in the spoken Thai language, the 'eee' sound *clearly* means 'bitch.' It's actually much more insulting. It's the term for a female animal and if used referring to a *human* female — well somebody's gonna get physically hurt. It's incredibly rude.

"It is about the *only* name you can call a Thai person that would get them more angry than calling them a 'water lizard.' Wow!

"The 'i' sound? It means 'bastard.' Naturally both 'iThailand' and 'eThailand' are online."

Fabulous! I couldn't e-make this i-stuff up! What is so amusing about the whole thing is that the use of "e-" and "i-" is simply a kind of puffery more than a real way of distinguishing electronic and informational businesses and products.

This raises the sticky question — is an i-greeting different from a regular greeting? No. Would Will S. have said, "What's in an e-name? That which we i-call an e-rose / By any other i-name would smell as e-sweet."? I think not.

Mind you, it isn't like misapplying simple concepts is a new idea. I would suggest that the old advertising saw "new and improved" is in the same vein. Most of what is called new is anything but, and improvements are most often in the packaging.

Now you will note that I will happily use "e-mail" as opposed to simply referring to "mail." That's because regular (snail) mail is a totally different medium — it is slow, error-prone and expensive whereas e-mail is fast, error-prone and cheap. See? Completely different.

If we can't use e- and i-, what can we use? Here's a radical suggestion: When there's no distinction that is meaningful, how about using nothing? That means that e-commerce is acceptable because it is radically different from regular commerce, whereas e-sales, being either a part of e-commerce or not being that different from regular sales (depending on your business) represents a bogus usage.

(And it just struck me that I should include the prefix "info-" in the same category as i-. It is an equally abused construct.)

It is time we started sneering, mocking and otherwise ridiculing those who would attempt to rely on the association of irrelevant concepts to confer market credibility on products and services.

I think I may have suggested something that could be the downfall of the PR-side of the entire computer industry.

Then e-where would we i-be?

E-comments to nwcolumn@gibbs.com.

'NET BUZZ

The latest on the Internet/intranet industry

PAUL MCNAMARA

Dan Riordan wants Yahoo to know that he's not a 2-year-old child and that he has no intention of divulging his credit card number over the Internet simply to prove his age to a misinformed database.

Riordan, whose verbal claim to be 37 is good enough for Buzz, works as a computer technologist for a group of school systems in New Jersey. Yahoo has been threatening to pull the plug on the grown man's Web-mail account because its records indicate that he is younger than 13; more precisely, according to Riordan's check of his online account, Yahoo believes him to be 2 years old. How this happened remains unclear, but Riordan believes the mix-up stems from Yahoo's acquisition two years ago of **Rocketmail,** the Web-mail service he originally established the account with without being asked about his age.

Whatever the genesis, Yahoo insists Riordan must provide a Visa, MasterCard or American Express number to them or wave good-bye to his free e-mail account.

"At this point, there is no other means, other than a valid credit card, that Yahoo uses to verify if the user is an adult," Yahoo explains in an e-mail to Riordan. "We are sorry for any inconvenience this may cause."

Interestingly enough, Yahoo puts the onus for this predicament on the shoulders of Congress, which as you know writes federal legislation and personifies the law of unintended consequences.

"Congress recently passed a law, called the **Children's Online Privacy Protection Act,** that requires sites that target kids or know that a visitor to their site is a child under 13 years old to follow certain Federal Trade Commission rules," Yahoo says. "One of the rules is that a site must get parental consent in order to collect personally identifying information from kids under the age of 13. "

That explanation doesn't impress Riordan.

"So instead of stopping the collection of personal information, they're collecting even more personal information," he says of the demand for his credit card number.

It's a conundrum, all right . . . But might he have considered actually asking his parents to contact Yahoo and vouch for his adulthood? Yahoo allows parents to open so-called "Family Accounts" that can empower the under-13 set.

"I've talked to them, but they said they're not taking responsibility for my e-mail."

Today's stock market gyrations are to an Internet start-up what a Dramamine shortage is to a cruise ship: bearable, but unsettling.

"What's worrisome to us is that we're going through our second round right now, so [market volatility] makes the money a little more expensive," says **Mark Lederhos,** vice president of marketing at **UDU World,** a start-up with roots in Australia. "We're hoping this settles down because we're looking to close on that second round in June."

Lederhos isn't fearful that the money guys will cut his company off, but says, "It's going to be a tougher negotiation as to how much of the company they want" in return.

UDU World — pronounced "You Do World" — makes client/server software called ActiveInBox that works with standard e-mail packages to let enterprises and service providers produce customized menus of miniature "go fetch it" applications. End users activate these applications with a click on a menu, which forwards a request to the UDU server, which in turn gathers the information from an intranet, the Web, an enterprise resource planning system or whatever, and returns the data packaged in an e-mail. The idea is to let people fetch stuff they really need without leaving the comfort of their in-boxes. Lederhos swears the things are a big hit Down Under.

The concept looks interesting, but fashioning those applications had better be as easy as he claims.

Sending a tip here couldn't be any easier. Try buzz@nww.com.

ALCATEL

ARCHITECTS OF AN INTERNET WORLD

An open letter to 3Com customers

You invested a lot of time and money in a network that met your organization's needs. Then on March 20, everything changed. Now, you have to invest a lot more time and money to determine where to go from here.

As you're making these deliberations, I'd like to give you some reasons to consider Alcatel as your networking partner.

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Alcatel is committed to networking. While some of our competitors are getting rid of their networking businesses, we're aggressively expanding ours. In the last two years, we've invested more than $18 billion in enterprise and public networking companies in North America. And, according to Dell'Oro Group research, in Q4 1999 we were the fastest growing Ethernet switch vendor in the industry by a wide margin.* We have a system of enterprise networking that integrates Gigabit Ethernet, layer 4+ switching, routing, ATM, 10/100 Ethernet, security, voice switching and least cost routing, wide area and wireless communications, network management, and much more…and it's all standards-based.

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I wish you luck as you make some tough decisions. I am confident that Alcatel can provide you with the network you'll need in the next decade. And I know that we will be a partner who is committed to your success. If you have any questions, please visit the Web site above, or call us at 800/995-2612.

Patrick Liot
President, Alcatel Internetworking

*Dell'Oro Group 4Q 99 Ethernet Switch Revenue Report

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